PATENT ABSTRACTS OF JAPAN

(11) Publication number : 2000 -305110
(43) Date of publication of application : 02.11.2000

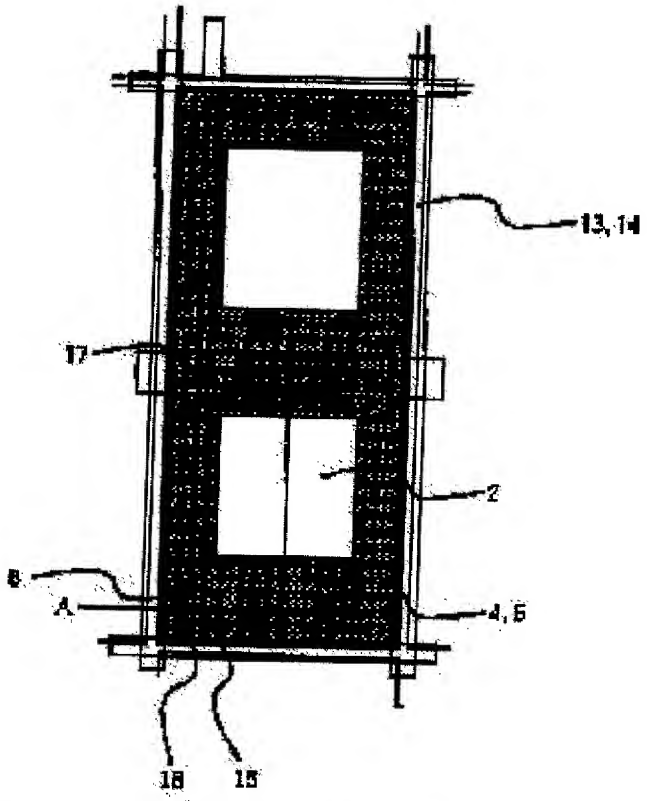
(51) Int.Cl. G02F 1/1365
G02F 1/1343
G09F 9/30
H01L 29/786
H01L 21/336
H04N 5/66

(21) Application number : 11 -110391
(22) Date of filing : 19.04.1999

(71) Applicant : SHARP CORP
(72) Inventor : KUBO MASUMI
YAMAMOTO AKIHIRO

(54) LIQUID CRYSTAL DISPLAY DEVICE

(57) Abstract:
PROBLEM TO BE SOLVED: To prevent contact failure between a reflection electrode and a thin film transistor, to improve the use efficiency of ambient light and to obtain good display characteristics by forming the reflection electrode on an interlayer insulating film and electrically connecting the reflection electrode and a transmission electrode in the border region of these electrodes.
SOLUTION: A thin film transistor 18, a transmission electrode 2 electrically connected to the drain electrode 13 of the thin film transistor 18, and reflection electrodes 4, 5 disposed on the thin film transistor 18 and the transmission electrode 2 through an interlayer insulating film are formed on an insulating substrate. The transmission electrode 2 and the reflection electrodes 4, 5



are electrically connected in the border region of these electrodes. By electrically connecting the reflection electrodes 4, 5 and the transparent electrode 2 in the border region, contact failure can be decreased, and the use efficiency of ambient light and the numerical aperture in the reflection electrode region can be improved to obtain good display performance.

LEGAL STATUS

[Date of request for examination]	25.01.2002
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3431856
[Date of registration]	23.05.2003
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The pixel electrode which constitutes the reflector which reflects outdoor daylight on the substrate of the one side of the substrates of the couple which counters mutually and is arranged on both sides of a liquid crystal layer, and the transparency electrode which penetrates the light from the tooth-back light source in 1 pixel, In the liquid crystal display with which it comes to form the switching element section which impresses the electrical potential difference for a display to this pixel electrode, while an interlayer insulation film is formed on the substrate of said one side It comes electrically to connect the drain electrode which constitutes said switching element section, and said transparency electrode under this interlayer insulation film. Said reflector The liquid crystal display characterized by connecting this reflector and a transparency electrode electrically in the border area of this reflector and a transparency electrode while being formed on said interlayer insulation film.
[Claim 2] Said interlayer insulation film is a liquid crystal display according to claim 1 characterized by covering all on the switching element section containing said drain electrode, being formed, and a contact hole not existing on said reflector.
[Claim 3] Said reflector and said transparency electrode are a liquid crystal display according to claim 1 characterized by connecting electrically only in the border area of this reflector and a transparency electrode.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the liquid crystal display used for the camcorder/movie equipped with OA equipment, such as a word processor and a personal computer, portable information devices, such as an electronic notebook, or a liquid crystal display monitor etc.
[0002]
[Description of the Prior Art] In recent years, the liquid crystal display is widely used for a word processor, a personal computer, television, a video camera, a still camera, a mounted monitor, pocket OA equipment, a handheld game machine, etc. taking advantage of the description of being a low power, with the thin shape.
[0003] The liquid crystal display of the transparency mold which used transparency electrodes, such as ITO (Indium Tin Oxide), for the pixel electrode, and the liquid crystal display of the reflective mold which used reflectors, such as a metal, for the pixel electrode are shown in such a liquid crystal display.
[0004] Originally, liquid crystal displays differ in CRT (Braun tube), EL (electroluminescence), etc., since they are not spontaneous light type displays which emit light themselves, in the case of the liquid crystal display of a transparency mold, arrange lighting systems, such as fluorescence tubing, and the so-called back light behind a liquid crystal display, and show to it by the light by which incidence is carried out from there. Moreover, in the case of the liquid crystal display of a reflective mold, it is displaying by reflecting the incident light from the outside with a reflector.
[0005] Without being influenced so much by surrounding brightness, in order to display here using a back light as mentioned above in the case of the liquid crystal display of a transparency mold, although it has the advantage that the display which is bright and has high contrast can be performed, since a back light consumes 50% or more of the total power consumption of a liquid crystal display, it also usually has the problem that power consumption will become large.
[0006] Moreover, in the case of the liquid crystal display of a reflective mold, although it has the advantage that power consumption can be made very small in order not to use a back light as mentioned above, it also has the problem that the brightness and contrast of a display by a surrounding operating environment or surrounding service conditions, such as brightness, will be influenced.
[0007] Thus, in the liquid crystal display of a reflective mold, when operating environments, such as surrounding brightness, especially outdoor daylight are dark, it has the fault that visibility falls extremely, and also in the liquid crystal display of one transparency mold, it had with this the problem that the visibility under fine weather etc. will fall to reverse when outdoor daylight is very bright.
[0008] As a means for solving such a trouble, the liquid crystal display having the function of both a reflective mold and a transparency mold is proposed by Japanese Patent Application No. No. 201176 [nine to] etc. The liquid crystal display proposed by this patent application By making the reflective display (reflector) which reflects outdoor daylight in one display pixel, and the transparency display (transparency electrode) which penetrates the light from a back light, when a perimeter is pitch-black As a transparency mold liquid crystal display which displays using the light which penetrates the transparency display from a back light, when outdoor daylight is dark As a mold liquid crystal

display in two ways which displays using both the light which penetrates the transparency display from a back light, and the light reflected by the reflective display formed with the comparatively high film of the rate of a light reflex Furthermore, when outdoor daylight is bright, it can use as a reflective mold liquid crystal display which displays only using the light reflected by the reflective display formed with the comparatively high film of the rate of a light reflex.

[0009] The liquid crystal display of such a configuration is not concerned with the brightness of outdoor daylight, but enables offer of the liquid crystal display in which visibility was always excellent, and explains it briefly [below] about the liquid crystal display of such a mold both for transparency reflective.

[0010] Drawing 10 is the top view having shown the configuration for a picture element part of the liquid crystal display of the mold both for transparency reflective explained as a conventional technique here, and drawing 11 is an A-A line sectional view in drawing 10 .

[0011] Moreover, drawing 12 (a) - (d) and drawing 13 (e) - (h) is the process sectional view having shown the production process of the transparency display and reflective display in a part for a picture element part of this type both for transparency reflective of liquid crystal display.

[0012] The transparency display and reflective display which constitute a part for the picture element part of the liquid crystal display of such a mold both for transparency reflective are explained with reference to drawing 10 -13. first, it is shown in drawing 12 (a) -- as -- the insulating substrate 1 top -- as the base coat film -- Ta2 -- insulator layers, such as O5 and Si02, are formed (not shown), after that, on the insulating substrate 1, patterning of the metal thin film which consists of aluminum, Mo, Ta, etc. is created and carried out by the sputtering method, and the gate electrode 8 is formed.

[0013] Next, the gate electrode 8 mentioned above is covered and the laminating of the gate dielectric film 10 is carried out on the insulating substrate 1. Generally, with P-CVD method, 3000A laminating of the SiNx film was carried out, and it considered as gate dielectric film 10. In addition, in order to raise insulation, anodizing the gate electrode 8, using this oxide film on anode as the 1st gate dielectric film 9, forming the insulator layers 10, such as SiN, with a CVD method, and considering as the 2nd insulator layer 10 is also considered.

[0014] Next, the channel layer 11 (amorphous silicon) and the electrode contact layer 12 (the amorphous silicon or microcrystal (Si) which doped impurities, such as Lynn) are continued on gate dielectric film 10, with a CVD method, 500A laminating is carried out to 1500A, respectively, patterning of both the Si film of the electrode contact layer 12 and the channel layer 11 is carried out by the dry etching method by HCl+SF6 mixed gas etc., and it is formed.

[0015] Then, as shown in drawing 12 (b), 1500A laminating of the transparence electric conduction film (ITO) 2 and 13 is carried out as an electrode material which constitutes a transparency display by the sputtering method, then the laminating of the metal thin films 14 and 15, such as aluminum, Mo, and Ta film, is carried out. And the drain electrodes 13 and 15 are formed in the source electrode 13 and 14 lists by carrying out patterning of these.

[0016] Next, as shown in drawing 12 (c), after carrying out 3000A laminating of the insulator layers, such as SiN, with a CVD method, it removes, patterning of the insulator layer which exists on the contact hole section 17 is carried out, and an interlayer film 7 is formed.

[0017] Next, two or more smooth concavo-convex sections 18 (not shown) are formed on a photopolymer 3 by heat-treating, after applying the photopolymer 3 used as an interlayer insulation film by about 4-micrometer thickness on this interlayer film 7 and exposing and developing this photopolymer 3, as shown in drawing 12 (d). And the photopolymer 3 which exists on contact hole section 17 field and a transparency display field is removed.

[0018] Next, as shown in drawing 13 (e), the aluminum/Mo film 4 and 5 is formed 1000/500A thickness by the sputtering method as an electrode material which constitutes a reflective display on the substrate 1 containing an interlayer film 7 and a photopolymer 3.

[0019] And as shown in drawing 13 (f), on the electrode material 4 which constitutes a reflective display, and 5, a photolithography process is used and a photoresist 16 is formed at a predetermined configuration. Since Mo5 exists between ITO2 which is the electrode material which constitutes a transparency display, and aluminum4 which is the electrode material which constitutes a reflective display at this time, although an electrolytic solution sinks in from the film defective part of aluminum4 at the time of the development of a photoresist 16, since this Mo5 functions as a barrier

metal, it has prevented that an electric corrosion reaction occurs.
[0020] And as shown in drawing 13 (g), the etchant which consists of nitric-acid + acetic-acid + phosphoric-acid + water is used, aluminum4/Mo5 which are the electrode material which constitutes a reflective display are etched simultaneously, and reflectors 4 and 5 are formed.
[0021] Finally, as shown in drawing 13 (h), the amount of [of the liquid crystal display of the mold both for transparency reflective mentioned above by removing the photoresist 16 formed by photolithography using the exfoliation equipment of a batch type] picture element part completes.
[0022] Here, the exfoliation equipment of a batch type used in order to remove the photoresist 16 formed by said photolithography is explained using drawing 14 . Drawing 14 (a) - (c) is the schematic diagram having shown the exfoliation process of the photoresist 16 of the batch type in the liquid crystal display of the mold both for transparency reflective mentioned above.
[0023] the substrate 20 which passed through a process which was mentioned above as shown in drawing 14 (a) - (c) -- as an amine -- MEA (monoethanolamine) -- 60wt(s)% -- it soaks in the exfoliation liquid 21 to contain, and in order to remove the exfoliation liquid 21 of substrate 20 front face after that, it soaks in water 22 and rinses. At this time, in the process in which the substrate 20 as shown in drawing 14 (b) is conveyed from an exfoliation tub to a rinse tank, it is in the condition that exfoliation liquid 21 adhered to substrate 20 front face, and by soaking this substrate 20 in a rinse tank, MEA21 and water 22 are mixed on substrate 20 front face, and alkalinity becomes strong.

[0024] however, in the liquid crystal display of the mold both for transparency reflective mentioned above In the border area of a transparency display and a reflective display, as shown in the sectional view of drawing 11 Since patterning of an interlayer film 7 and the reflectors 4 and 5 is carried out so that ITO2 which is the electrode material which constitutes a transparency display, and aluminum4/Mo5 which are the electrode material which constitutes a reflective display may not contact directly A photoresist 16 is removable, without causing electric corrosion between ITO2 which is a transparency electrode material, and aluminum4 which is a reflector ingredient.
[0025] Thus, the orientation film is applied and calcinated to each of the TFT substrate which has a part for the manufactured picture element part, and the transparent opposite substrate (not shown) with which the transparency electrode was formed. And rubbing processing is performed to this orientation film, after sprinkling a spacer, liquid crystal is poured in for both these substrates by lamination and the vacuum pouring-in method by seal resin, and a liquid crystal display component is created. The liquid crystal display of the mold both for transparency reflective mentioned above by pouring in a liquid crystal ingredient, installing a polarizing plate and one phase contrast plate at a time in the both sides of a liquid crystal display component finally, respectively, and installing a back light in a tooth back is completed.
[0026]
[Problem(s) to be Solved by the Invention] Since the interlayer film 7 is formed so that the electrode material 2 which constitutes a transparency display, and the electrode materials 4 and 5 which constitute a reflective display may not contact directly, the liquid crystal display of the mold both for transparency reflective of a configuration as mentioned above is an effective configuration to preventing the electric corrosion which happens between the transparency electrode material 2 and the reflector ingredients 4 and 5.
[0027] However, in such a configuration, since the lap part of the electrode material 2 which constitutes a transparency display, the electrode materials 4 and 5 which constitute a reflective display, and an interlayer film 7 became the invalid viewing area which cannot be used for a transparency display and a reflective display, being in a display pixel field, it had the trouble that a numerical aperture will fall as a display.
[0028] Moreover, the interlayer film 7 in the reflective field at this time, and the border area of a transparency field Reflectors 4 and 5 need to carry out patterning gap consideration, and it is necessary to form quite more greatly than the edge part of reflectors 4 and 5. The sake, The field which must impress an electrical potential difference to liquid crystal through an interlayer film 7 in a part of transparency field will exist, and it also had the problem that the permeability and contrast of a display in a transparency field will fall.
[0029] Furthermore, when performing a reflective display in the liquid crystal display of such a mold

both for transparency reflective, reservation of the area of the reflectors 4 and 5 for performing sufficient reflective display became difficult from having to divide one pixel in a transparency field and a reflective field, and also the contact hole 17 existing in this reflective field, and it also had the trouble that the utilization effectiveness of an ambient light was bad.

[0030] Generally, in the liquid crystal display of a mold both for transparency reflective which was mentioned above, since it is necessary to connect the transparency electrode 2 and reflectors 4 and 5 electrically through an interlayer insulation film (photopolymer) 3, it is necessary to form a contact hole 17 in an interlayer insulation film 3. To use polarization mode especially, it is necessary to aim at matching of the electro-optics property between these both by adjusting the optical path length of a reflective field and a transparency field using the thickness of an interlayer insulation film 3. Usually, it is necessary to set the thickness of the liquid crystal layer of a transparency field as about 2 times of the thickness of the liquid crystal layer of a reflective field. Since the liquid crystal thickness of a transparency field is usually about 5-6 micrometers, it is necessary to form an interlayer insulation film 3 in the thick thickness of [that the liquid crystal thickness of a reflective field is set to about 2.5-3 micrometers] about 3 micrometers. For example, this sake, It also has the problem that will be easy to generate the faulty connection in a contact hole 17, and the area of a contact hole 17 will also become large, and the utilization effectiveness of reflectors 4 and 5 will worsen.

[0031] It is made hard to happen in poor contact of the reflector of the liquid crystal display of the mold both for transparency reflective, and a thin film transistor, and the place which this invention is made in view of the trouble of these former, and is made into the object raises the utilization effectiveness of an ambient light, and is to offer the liquid crystal display of the mold both for transparency reflective which has a good display property.

[0032]

[Means for Solving the Problem] In order to attain the object mentioned above, the liquid crystal display of this invention The pixel electrode which constitutes the reflector which reflects outdoor daylight on the substrate of the one side of the substrates of the couple which counters mutually and is arranged on both sides of a liquid crystal layer, and the transparency electrode which penetrates the light from the tooth-back light source in 1 pixel, In the liquid crystal display with which it comes to form the switching element section which impresses the electrical potential difference for a display to this pixel electrode, while an interlayer insulation film is formed on the substrate of said one side It comes electrically to connect the drain electrode which constitutes said switching element section, and said transparency electrode under this interlayer insulation film. Said reflector While being formed on said interlayer insulation film, it is characterized by connecting this reflector and a transparency electrode electrically in the border area of this reflector and a transparency electrode.

[0033] Moreover, it is desirable that said interlayer insulation film at this time covers all on the switching element section containing said drain electrode, and is formed, and a contact hole does not exist on said reflector.

[0034] Furthermore, as for said reflector and said transparency electrode at this time, it is desirable to connect electrically only in the border area of this reflector and a transparency electrode.

[0035] Hereafter, an operation of this invention is explained.

[0036] Without making the invalid viewing area in a display pixel field increase conventionally, since according to the liquid crystal display of this invention it is constituted so that a reflector and a transparency electrode may connect electrically in the border area of a reflector and a transparency electrode, two electrodes can be connected certainly and it is possible to reduce poor contact.

[0037] Moreover, since a reflector and a transparency electrode can be connected electrically, without forming the contact hole which existed in the reflector field in a display pixel field until now, it is also possible to raise the numerical aperture of a reflector field and to raise the utilization effectiveness of an ambient light.

[0038] Furthermore, since it becomes unnecessary to form the interlayer film which existed between the reflector and the transparency electrode until now, it is also possible for impressing an electrical potential difference to liquid crystal through an interlayer film to be lost, and to raise the display engine performance of a transparency electrode field.

[0039]

[Embodiment of the Invention] Hereafter, the gestalt of the operation in this invention is explained based on a drawing.
[0040] (Gestalt 1 of operation) Drawing 1 is the top view having shown the configuration for a picture element part of the liquid crystal display in the gestalt 1 of this operation, and drawing 2 is the A-A line sectional view.
[0041] The liquid crystal display of the gestalt 1 of this operation is formed on the insulating substrate 1 from a thin film transistor 18, the transparency electrode 2 electrically connected to the drain electrode 13 of this thin film transistor 18, and this thin film transistor 18 and the transparency electrode 2 and the reflectors 4 and 5 arranged through an interlayer insulation film 3, as shown in drawing 1 and drawing 2 . And in that border area, it connects electrically and these transparency electrode 2 and reflectors 4 and 5 are constituted.
[0042] Thus, since the transparency electrode 2 and reflectors 4 and 5 which constitute a pixel electrode from a liquid crystal display in the gestalt 1 of this operation are contacted directly and connected electrically, it is possible to use conventionally the invalid viewing area which was not able to be used for the transparency viewing area and the reflective viewing area as a connection of the transparency electrode 2 and reflectors 4 and 5.
[0043] Moreover, by considering as such a configuration, it is possible to prevent conventionally the faulty connection of the transparency electrode 2 and reflectors 4 and 5 which had been generated in the contact hole, and it is also possible to raise the rate of an excellent article of a liquid crystal display.
[0044] As a cure against electric corrosion in the photoresist exfoliation process of the cascade screen pattern of aluminum4/Mo5 which originates in contacting directly the transparency electrode 2 and reflectors 4 and 5 which constitute a pixel electrode, and connecting them electrically here, and is generated With the gestalt 1 of this operation, a backwashing-by-water process which prevents preparing two or more another tubs in front of a rinse tank, and the water and MEA in a rinse tank being mixed, and becoming alkalinity is performed so that it may mention later.
[0045] Here, drawing 3 (a) - (d) and drawing 4 (e) - (h) is the sectional view having shown the process of the transparency display and reflective display in a part for a picture element part of a liquid crystal display in the gestalt 1 of this operation.
[0046] The transparency display and reflective display which constitute a part for the picture element part of the liquid crystal display in the gestalt 1 of this operation are explained with reference to (a) - (h) of drawing 3 and drawing 4 . first, it is shown in drawing 3 (a) -- as -- the insulating substrate 1 top -- as the base coat film -- Ta2 -- insulator layers, such as O5 and Si02, are formed (not shown), after that, patterning of the metal thin film which becomes the insulating substrate 1 from aluminum, Mo, Ta, etc. is created and carried out by the sputtering method, and the gate electrode 8 is formed.
[0047] Next, the gate electrode 8 mentioned above is covered and the laminating of the gate dielectric film 10 is carried out on the insulating substrate 1. Generally, with P-CVD method, 3000A laminating of the SiNx film was carried out, and it considered as gate dielectric film 10. In addition, in order to raise insulation, anodizing the gate electrode 8, using this oxide film on anode as the 1st gate dielectric film 9, forming the insulator layers 10, such as SiN, with a CVD method, and considering as the 2nd insulator layer 10 is also considered.
[0048] Next, the channel layer 11 (amorphous silicon) and the electrode contact layer 12 (the amorphous silicon or microcrystal (Si) which doped impurities, such as Lynn) are continued on gate dielectric film 10, with a CVD method, 500A laminating is carried out to 1500A, respectively, patterning of both the Si film of the electrode contact layer 12 and the channel layer 11 is carried out by the dry etching method by HCl+SF6 mixed gas etc., and it is formed.
[0049] Then, as shown in drawing 3 (b), 1500A laminating of the transparence electric conduction film (ITO) 2 and 13 is carried out as an electrode material which constitutes a transparency display by the sputtering method, then the laminating of the metal thin films 14 and 15, such as aluminum, Mo, and Ta film, is carried out. And the drain electrodes 13 and 15 are formed in the source electrode 13 and 14 lists by carrying out patterning of these. The drain electrode 13 and the electrode material 2 which constitutes a transparency display are connected electrically by this, and it is constituted.
[0050] Next, as shown in drawing 3 (c), 3000A laminating of the insulator layers, such as SiN, is

carried out with a CVD method, it removes, patterning of the insulator layer which exists in the transparency viewing-area and contact hole section 17 top and the border area of a transparency viewing area and a reflective viewing area is carried out, and an interlayer film 7 is formed. Here, when removing an interlayer film 7 with the gestalt 1 of this operation, only a transparency viewing area was not removed but the interlayer film 7 which exists throughout the border area of a transparency viewing area and a transparency viewing area, and a reflective viewing area was removed. In addition, it is not necessary to necessarily remove the interlayer film 7 which exists in the border area of a transparency viewing area and a reflective viewing area over the whole region, and does not matter by removing the part as a configuration which the transparency electrode 2 and reflectors 4 and 5 connect electrically.

[0051] Next, two or more smooth concavo-convex sections 18 (not shown) are formed on a photopolymer 3 by heat-treating, after applying the photopolymer 3 used as an interlayer insulation film by about 4-micrometer thickness on this interlayer film 7 and exposing and developing this photopolymer 3, as shown in drawing 3 (d). And the photopolymer 3 which exists on contact hole section 17 field and a transparency display field is removed.

[0052] Next, as shown in drawing 4 (e), the aluminum/Mo film 4 and 5 is formed 1000/500A thickness by the sputtering method as an electrode material which constitutes a reflective display on the substrate 1 containing an interlayer film 7 and a photopolymer 3.

[0053] And as shown in drawing 4 (f), on the electrode material 4 which constitutes a reflective display, and 5, a photolithography process is used and a photoresist 16 is formed at a predetermined configuration. Since Mo5 exists between ITO2 which is the electrode material which constitutes a transparency display, and aluminum4 which is the electrode material which constitutes a reflective display at this time, although an electrolytic solution sinks in from the film defective part of aluminum4 at the time of the development of a photoresist 16, since this Mo5 functions as a barrier metal, it has prevented that an electric corrosion reaction occurs.

[0054] And as shown in drawing 4 (g), the etchant which consists of nitric-acid + acetic-acid + phosphoric-acid + water is used, aluminum4/Mo5 which are the electrode material which constitutes a reflective display are etched simultaneously, and reflectors 4 and 5 are formed.

[0055] Finally, as shown in drawing 4 (h), the amount of [of the liquid crystal display of the mold both for transparency reflective mentioned above by removing the photoresist 16 formed by photolithography using the exfoliation equipment of a batch type] picture element part completes.

[0056] Here, the exfoliation equipment of a batch type used in order to remove the photoresist 16 formed by said photolithography is explained using drawing 5 . Drawing 5 (a) - (e) is the schematic diagram having shown the exfoliation process of the photoresist 16 of the batch type in the liquid crystal display of the mold both for transparency reflective mentioned above.

[0057] the substrate 20 which passed through a process which was mentioned above as shown in drawing 5 (a) - (e) -- as an amine -- MEA (monoethanolamine) -- 60wt(s)% -- in order to soak in the exfoliation liquid to contain and to remove the exfoliation liquid of substrate 20 front face after that, it soaks in a rinse tank 22 and rinses. After exfoliating in the exfoliation tub 21 like before shown in drawing 14 at this time, it washes in cold water in order of the exfoliation tub 21 (DMSO tub) which uses dimethyl sulfoxide as a principal component, and a rinse tank 22. If exfoliation is repeated without performing liquid exchange of the exfoliation tub 21 and a rinse tank 22 The MEA concentration in the exfoliation tub 21 becomes high, MEA will be continuously carried in in a rinse tank 22, alkalinity will become strong, and electric corrosion will occur in the contact part of the transparency electrode 2 and reflectors 4 and 5 in the border area of a transparency viewing area and a reflective viewing area.

[0058] So, with the gestalt 1 of this operation, as shown in drawing 5 (a) - (e), after dipping the substrate 20 in the exfoliation tub 21 and exfoliating, 2 ********s of another exfoliation tubs 21 were passed, and it rinsed by dipping in a rinse tank 22. By such approach, MEA is conventionally carried in in a rinse tank 22, alkalinity becomes strong, and it becomes possible to hardly carry in MEA no longer in a rinse tank 22, and to prevent generating of electric corrosion because what electric corrosion had generated in the contact part of the transparency electrode 2 and reflectors 4 and 5 in the border area of a transparency viewing area and a reflective viewing area makes the exfoliation tub 21 (DMSO tub) two tubs.

[0059] Thus, the orientation film is applied and calcinated to each of the TFT substrate which has a part for the manufactured picture element part, and the transparent opposite substrate (not shown) with which the transparency electrode was formed. And rubbing processing is performed to this orientation film, after sprinkling a spacer, liquid crystal is poured in for both these substrates by lamination and the vacuum pouring-in method by seal resin, and a liquid crystal display component is created. The liquid crystal display of the mold both for transparency reflective mentioned above by pouring in a liquid crystal ingredient, installing a polarizing plate and one phase contrast plate at a time in the both sides of a liquid crystal display component finally, respectively, and installing a back light in a tooth back is completed.
[0060] (Gestalt 2 of operation) Drawing 6 is the top view having shown the configuration for a picture element part of the liquid crystal display in the gestalt 2 of this operation, and drawing 7 is the A-A line sectional view.
[0061] The liquid crystal display of the gestalt 2 of this operation is formed on the insulating substrate 1 from a thin film transistor 18, the transparency electrode 2 electrically connected to the drain electrode 13 of this thin film transistor 18, and this thin film transistor 18 and the transparency electrode 2 and the reflectors 4 and 5 arranged through an interlayer insulation film 3, as shown in drawing 6 and drawing 7 . And in that border area, it connects electrically and these transparency electrode 2 and reflectors 4 and 5 are constituted.
[0062] Thus, since the transparency electrode 2 and reflectors 4 and 5 which constitute a pixel electrode from a liquid crystal display in the gestalt 2 of this operation are contacted directly and connected electrically, it is possible to use conventionally the invalid viewing area which was not able to be used for the transparency viewing area and the reflective viewing area as a connection of the transparency electrode 2 and reflectors 4 and 5.
[0063] Moreover, by considering as such a configuration, it is possible to prevent conventionally the faulty connection of the transparency electrode 2 and reflectors 4 and 5 which had been generated in the contact hole, and it is also possible to raise the rate of an excellent article of a liquid crystal display.
[0064] In addition, the liquid crystal displays in the gestalt 2 of this operation differ in the gestalt 1 of operation which the point which does not form the contact hole in the reflectors 4 and 5 formed on the interlayer insulation film 3 mentioned above, as shown in drawing 6 and drawing 7 .
[0065] Here, drawing 8 (a) - (d) and drawing 9 (e) - (h) is the sectional view having shown the process of the transparency display and reflective display in a part for a picture element part of a liquid crystal display in the gestalt 2 of this operation.
[0066] The transparency display and reflective display which constitute a part for the picture element part of the liquid crystal display in the gestalt 2 of this operation are explained with reference to (a) - (h) of drawing 8 and drawing 9 . first, it is shown in drawing 8 (a) -- as -- the insulating substrate 1 top -- as the base coat film -- Ta2 -- insulator layers, such as O5 and Si02, are formed (not shown), after that, patterning of the metal thin film which becomes the insulating substrate 1 from aluminum, Mo, Ta, etc. is created and carried out by the sputtering method, and the gate electrode 8 is formed.
[0067] Next, the gate electrode 8 mentioned above is covered and the laminating of the gate dielectric film 10 is carried out on the insulating substrate 1. Generally, with P-CVD method, 3000A laminating of the SiNx film was carried out, and it considered as gate dielectric film 10. In addition, in order to raise insulation, anodizing the gate electrode 8, using this oxide film on anode as the 1st gate dielectric film 9, forming the insulator layers 10, such as SiN, with a CVD method, and considering as the 2nd insulator layer 10 is also considered.
[0068] Next, the channel layer 11 (amorphous silicon) and the electrode contact layer 12 (the amorphous silicon or microcrystal (Si) which doped impurities, such as Lynn) are continued on gate dielectric film 10, with a CVD method, 500A laminating is carried out to 1500A, respectively, patterning of both the Si film of the electrode contact layer 12 and the channel layer 11 is carried out by the dry etching method by HCl+SF6 mixed gas etc., and it is formed.
[0069] Then, as shown in drawing 8 (b), 1500A laminating of the transparence electric conduction film (ITO) 2 and 13 is carried out as an electrode material which constitutes a transparency display by the sputtering method, then the laminating of the metal thin films 14 and 15, such as aluminum, Mo, and Ta film, is carried out. And the drain electrodes 13 and 15 are formed in the source

electrode 13 and 14 lists by carrying out patterning of these. The drain electrode 13 and the electrode material 2 which constitutes a transparency display are connected electrically by this, and it is constituted.

[0070] Next, as shown in drawing 8 (c), 3000A laminating of the insulator layers, such as SiN, is carried out with a CVD method, it removes, patterning of the insulator layer which exists in the border area of a transparency viewing area and a transparency viewing area, and a reflective viewing area is carried out, and an interlayer film 7 is formed. Here, when removing an interlayer film 7 with the gestalt 2 of this operation, only a transparency viewing area was not removed but the interlayer film 7 which exists throughout the border area of a transparency viewing area and a transparency viewing area, and a reflective viewing area was removed. In addition, it is not necessary to necessarily remove the interlayer film 7 which exists in the border area of a transparency viewing area and a reflective viewing area over the whole region, and does not matter by removing the part as a configuration which the transparency electrode 2 and reflectors 4 and 5 connect electrically.

[0071] Next, two or more smooth concavo-convex sections 18 (not shown) are formed on a photopolymer 3 by heat-treating, after applying the photopolymer 3 used as an interlayer insulation film by about 4-micrometer thickness on this interlayer film 7 and exposing and developing this photopolymer 3, as shown in drawing 8 (d). And the photopolymer 3 which exists on contact hole section 17 field and a transparency display field is removed.

[0072] Next, as shown in drawing 9 (e), the aluminum/Mo film 4 and 5 is formed 1000/500A thickness by the sputtering method as an electrode material which constitutes a reflective display on the substrate 1 containing an interlayer film 7 and a photopolymer 3.

[0073] And as shown in drawing 9 (f), on the electrode material 4 which constitutes a reflective display, and 5, a photolithography process is used and a photoresist 16 is formed at a predetermined configuration. Since Mo5 exists between ITO2 which is the electrode material which constitutes a transparency display, and aluminum4 which is the electrode material which constitutes a reflective display at this time, although an electrolytic solution sinks in from the film defective part of aluminum4 at the time of the development of a photoresist 16, since this Mo5 functions as a barrier metal, it has prevented that an electric corrosion reaction occurs.

[0074] And as shown in drawing 9 (g), the etchant which consists of nitric-acid + acetic-acid + phosphoric-acid + water is used, aluminum4/Mo5 which are the electrode material which constitutes a reflective display are etched simultaneously, and reflectors 4 and 5 are formed.

[0075] Finally, as shown in drawing 9 (h), the amount of [of the liquid crystal display of the mold both for transparency reflective in the gestalt 2 of this operation] picture element part completes by removing like the gestalt 1 of the operation which mentioned above the photoresist 16 formed by photolithography using the exfoliation equipment of a batch type.

[0076] Thus, the orientation film is applied and calcinated to each of the TFT substrate which has a part for the manufactured picture element part, and the transparent opposite substrate (not shown) with which the transparency electrode was formed. And rubbing processing is performed to this orientation film, after sprinkling a spacer, liquid crystal is poured in for both these substrates by lamination and the vacuum pouring-in method by seal resin, and a liquid crystal display component is created. The liquid crystal display of the mold both for transparency reflective mentioned above by pouring in a liquid crystal ingredient, installing a polarizing plate and one phase contrast plate at a time in the both sides of a liquid crystal display component finally, respectively, and installing a back light in a tooth back is completed.

[0077] Since the contact hole does not exist in the reflectors 4 and 5 formed on the interlayer insulation film 3 according to the liquid crystal display in the gestalt 2 of this operation, Irregularity can be formed also in the field on the interlayer insulation film 3 which was being conventionally made into the contact hole. The contact hole part which was not able to be used for a transparency viewing area and a reflective viewing area can be used as a reflective viewing area, and it is possible to make effective display pixel area expand.

[0078]

[Effect of the Invention] Without making the invalid viewing area in a display pixel field increase conventionally, since it is constituted like the above explanation according to the liquid crystal display of this invention so that a reflector and a transparency electrode may connect electrically in

the border area of a reflector and a transparency electrode, two electrodes can be connected certainly and it is possible to reduce poor contact.

[0079] Moreover, since a reflector and a transparency electrode can be connected electrically, without forming the contact hole which existed in the reflector field in a display pixel field until now, it is also possible to raise the numerical aperture of a reflector field and to raise the utilization effectiveness of an ambient light.

[0080] Furthermore, since it becomes unnecessary to form the interlayer film which existed between the reflector and the transparency electrode until now, it is also possible for impressing an electrical potential difference to liquid crystal through an interlayer film to be lost, and to raise the display engine performance of a transparency electrode field.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the liquid crystal display used for the camcorder/movie equipped with OA equipment, such as a word processor and a personal computer, portable information devices, such as an electronic notebook, or a liquid crystal display monitor etc.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] In recent years, the liquid crystal display is widely used for a word processor, a personal computer, television, a video camera, a still camera, a mounted monitor, pocket OA equipment, a handheld game machine, etc. taking advantage of the description of being a low power, with the thin shape.
[0003] The liquid crystal display of the transparency mold which used transparency electrodes, such as ITO (Indium Tin Oxide), for the pixel electrode, and the liquid crystal display of the reflective mold which used reflectors, such as a metal, for the pixel electrode are shown in such a liquid crystal display.
[0004] Originally, liquid crystal displays differ in CRT (Braun tube), EL (electroluminescence), etc., since they are not spontaneous light type displays which emit light themselves, in the case of the liquid crystal display of a transparency mold, arrange lighting systems, such as fluorescence tubing, and the so-called back light behind a liquid crystal display, and show to it by the light by which incidence is carried out from there. Moreover, in the case of the liquid crystal display of a reflective mold, it is displaying by reflecting the incident light from the outside with a reflector.
[0005] Without being influenced so much by surrounding brightness, in order to display here using a back light as mentioned above in the case of the liquid crystal display of a transparency mold, although it has the advantage that the display which is bright and has high contrast can be performed, since a back light consumes 50% or more of the total power consumption of a liquid crystal display, it also usually has the problem that power consumption will become large.
[0006] Moreover, in the case of the liquid crystal display of a reflective mold, although it has the advantage that power consumption can be made very small in order not to use a back light as mentioned above, it also has the problem that the brightness and contrast of a display by a surrounding operating environment or surrounding service conditions, such as brightness, will be influenced.
[0007] Thus, in the liquid crystal display of a reflective mold, when operating environments, such as surrounding brightness, especially outdoor daylight are dark, it has the fault that visibility falls extremely, and also in the liquid crystal display of one transparency mold, it had with this the problem that the visibility under fine weather etc. will fall to reverse when outdoor daylight is very bright.
[0008] As a means for solving such a trouble, the liquid crystal display having the function of both a reflective mold and a transparency mold is proposed by Japanese Patent Application No. No. 201176 [nine to] etc. The liquid crystal display proposed by this patent application By making the reflective display (reflector) which reflects outdoor daylight in one display pixel, and the transparency display (transparency electrode) which penetrates the light from a back light, when a perimeter is pitch-black As a transparency mold liquid crystal display which displays using the light which penetrates the transparency display from a back light, when outdoor daylight is dark As a mold liquid crystal display in two ways which displays using both the light which penetrates the transparency display from a back light, and the light reflected by the reflective display formed with the comparatively high film of the rate of a light reflex Furthermore, when outdoor daylight is bright, it can use as a reflective mold liquid crystal display which displays only using the light reflected by the reflective display formed with the comparatively high film of the rate of a light reflex.
[0009] The liquid crystal display of such a configuration is not concerned with the brightness of

outdoor daylight, but enables offer of the liquid crystal display in which visibility was always excellent, and explains it briefly [below] about the liquid crystal display of such a mold both for transparency reflective.

[0010] Drawing 10 is the top view having shown the configuration for a picture element part of the liquid crystal display of the mold both for transparency reflective explained as a conventional technique here, and drawing 11 is an A-A line sectional view in drawing 10 .

[0011] Moreover, drawing 12 (a) - (d) and drawing 13 (e) - (h) is the process sectional view having shown the production process of the transparency display and reflective display in a part for a picture element part of this type both for transparency reflective of liquid crystal display.

[0012] The transparency display and reflective display which constitute a part for the picture element part of the liquid crystal display of such a mold both for transparency reflective are explained with reference to drawing 10 -13. first, it is shown in drawing 12 (a) -- as -- the insulating substrate 1 top -- as the base coat film -- Ta2 -- insulator layers, such as O5 and Si02, are formed (not shown), after that, on the insulating substrate 1, patterning of the metal thin film which consists of aluminum, Mo, Ta, etc. is created and carried out by the sputtering method, and the gate electrode 8 is formed.

[0013] Next, the gate electrode 8 mentioned above is covered and the laminating of the gate dielectric film 10 is carried out on the insulating substrate 1. Generally, with P-CVD method, 3000A laminating of the SiNx film was carried out, and it considered as gate dielectric film 10. In addition, in order to raise insulation, anodizing the gate electrode 8, using this oxide film on anode as the 1st gate dielectric film 9, forming the insulator layers 10, such as SiN, with a CVD method, and considering as the 2nd insulator layer 10 is also considered.

[0014] Next, the channel layer 11 (amorphous silicon) and the electrode contact layer 12 (the amorphous silicon or microcrystal (Si) which doped impurities, such as Lynn) are continued on gate dielectric film 10, with a CVD method, 500A laminating is carried out to 1500A, respectively, patterning of both the Si film of the electrode contact layer 12 and the channel layer 11 is carried out by the dry etching method by HCl+SF6 mixed gas etc., and it is formed.

[0015] Then, as shown in drawing 12 (b), 1500A laminating of the transparence electric conduction film (ITO) 2 and 13 is carried out as an electrode material which constitutes a transparency display by the sputtering method, then the laminating of the metal thin films 14 and 15, such as aluminum, Mo, and Ta film, is carried out. And the drain electrodes 13 and 15 are formed in the source electrode 13 and 14 lists by carrying out patterning of these.

[0016] Next, as shown in drawing 12 (c), after carrying out 3000A laminating of the insulator layers, such as SiN, with a CVD method, it removes, patterning of the insulator layer which exists on the contact hole section 17 is carried out, and an interlayer film 7 is formed.

[0017] Next, two or more smooth concavo-convex sections 18 (not shown) are formed on a photopolymer 3 by heat-treating, after applying the photopolymer 3 used as an interlayer insulation film by about 4-micrometer thickness on this interlayer film 7 and exposing and developing this photopolymer 3, as shown in drawing 12 (d). And the photopolymer 3 which exists on contact hole section 17 field and a transparency display field is removed.

[0018] Next, as shown in drawing 13 (e), the aluminum/Mo film 4 and 5 is formed 1000/500A thickness by the sputtering method as an electrode material which constitutes a reflective display on the substrate 1 containing an interlayer film 7 and a photopolymer 3.

[0019] And as shown in drawing 13 (f), on the electrode material 4 which constitutes a reflective display, and 5, a photolithography process is used and a photoresist 16 is formed at a predetermined configuration. Since Mo5 exists between ITO2 which is the electrode material which constitutes a transparency display, and aluminum4 which is the electrode material which constitutes a reflective display at this time, although an electrolytic solution sinks in from the film defective part of aluminum4 at the time of the development of a photoresist 16, since this Mo5 functions as a barrier metal, it has prevented that an electric corrosion reaction occurs.

[0020] And as shown in drawing 13 (g), the etchant which consists of nitric-acid + acetic-acid + phosphoric-acid + water is used, aluminum4/Mo5 which are the electrode material which constitutes a reflective display are etched simultaneously, and reflectors 4 and 5 are formed.

[0021] Finally, as shown in drawing 13 (h), the amount of [of the liquid crystal display of the mold both for transparency reflective mentioned above by removing the photoresist 16 formed by

photolithography using the exfoliation equipment of a batch type] picture element part completes.
[0022] Here, the exfoliation equipment of a batch type used in order to remove the photoresist 16 formed by said photolithography is explained using drawing 14 . Drawing 14 (a) - (c) is the schematic diagram having shown the exfoliation process of the photoresist 16 of the batch type in the liquid crystal display of the mold both for transparency reflective mentioned above.
[0023] the substrate 20 which passed through a process which was mentioned above as shown in drawing 14 (a) - (c) -- as an amine -- MEA (monoethanolamine) -- 60wt(s)% -- it soaks in the exfoliation liquid 21 to contain, and in order to remove the exfoliation liquid 21 of substrate 20 front face after that, it soaks in water 22 and rinses. At this time, in the process in which the substrate 20 as shown in drawing 14 (b) is conveyed from an exfoliation tub to a rinse tank, it is in the condition that exfoliation liquid 21 adhered to substrate 20 front face, and by soaking this substrate 20 in a rinse tank, MEA21 and water 22 are mixed on substrate 20 front face, and alkalinity becomes strong.

[0024] however, in the liquid crystal display of the mold both for transparency reflective mentioned above In the border area of a transparency display and a reflective display, as shown in the sectional view of drawing 11 Since patterning of an interlayer film 7 and the reflectors 4 and 5 is carried out so that ITO2 which is the electrode material which constitutes a transparency display, and aluminum4/Mo5 which are the electrode material which constitutes a reflective display may not contact directly A photoresist 16 is removable, without causing electric corrosion between ITO2 which is a transparency electrode material, and aluminum4 which is a reflector ingredient.
[0025] Thus, the orientation film is applied and calcinated to each of the TFT substrate which has a part for the manufactured picture element part, and the transparent opposite substrate (not shown) with which the transparency electrode was formed. And rubbing processing is performed to this orientation film, after sprinkling a spacer, liquid crystal is poured in for both these substrates by lamination and the vacuum pouring-in method by seal resin, and a liquid crystal display component is created. The liquid crystal display of the mold both for transparency reflective mentioned above by pouring in a liquid crystal ingredient, installing a polarizing plate and one phase contrast plate at a time in the both sides of a liquid crystal display component finally, respectively, and installing a back light in a tooth back is completed.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] Without making the invalid viewing area in a display pixel field increase conventionally, since it is constituted like the above explanation according to the liquid crystal display of this invention so that a reflector and a transparency electrode may connect electrically in the border area of a reflector and a transparency electrode, two electrodes can be connected certainly and it is possible to reduce poor contact.
[0079] Moreover, since a reflector and a transparency electrode can be connected electrically, without forming the contact hole which existed in the reflector field in a display pixel field until now, it is also possible to raise the numerical aperture of a reflector field and to raise the utilization effectiveness of an ambient light.
[0080] Furthermore, since it becomes unnecessary to form the interlayer film which existed between the reflector and the transparency electrode until now, it is also possible for impressing an electrical potential difference to liquid crystal through an interlayer film to be lost, and to raise the display engine performance of a transparency electrode field.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Since the interlayer film 7 is formed so that the electrode material 2 which constitutes a transparency display, and the electrode materials 4 and 5 which constitute a reflective display may not contact directly, the liquid crystal display of the mold both for transparency reflective of a configuration as mentioned above is an effective configuration to preventing the electric corrosion which happens between the transparency electrode material 2 and the reflector ingredients 4 and 5.
[0027] However, in such a configuration, since the lap part of the electrode material 2 which constitutes a transparency display, the electrode materials 4 and 5 which constitute a reflective display, and an interlayer film 7 became the invalid viewing area which cannot be used for a transparency display and a reflective display, being in a display pixel field, it had the trouble that a numerical aperture will fall as a display.
[0028] Moreover, the interlayer film 7 in the reflective field at this time, and the border area of a transparency field Reflectors 4 and 5 need to carry out patterning gap consideration, and it is necessary to form quite more greatly than the edge part of reflectors 4 and 5. The sake, The field which must impress an electrical potential difference to liquid crystal through an interlayer film 7 in a part of transparency field will exist, and it also had the problem that the permeability and contrast of a display in a transparency field will fall.
[0029] Furthermore, when performing a reflective display in the liquid crystal display of such a mold both for transparency reflective, reservation of the area of the reflectors 4 and 5 for performing sufficient reflective display became difficult from having to divide one pixel in a transparency field and a reflective field, and also the contact hole 17 existing in this reflective field, and it also had the trouble that the utilization effectiveness of an ambient light was bad.
[0030] Generally, in the liquid crystal display of a mold both for transparency reflective which was mentioned above, since it is necessary to connect the transparency electrode 2 and reflectors 4 and 5 electrically through an interlayer insulation film (photopolymer) 3, it is necessary to form a contact hole 17 in an interlayer insulation film 3. To use polarization mode especially, it is necessary to aim at matching of the electro-optics property between these both by adjusting the optical path length of a reflective field and a transparency field using the thickness of an interlayer insulation film 3. Usually, it is necessary to set the thickness of the liquid crystal layer of a transparency field as about 2 times of the thickness of the liquid crystal layer of a reflective field. Since the liquid crystal thickness of a transparency field is usually about 5-6 micrometers, it is necessary to form an interlayer insulation film 3 in the thick thickness of [that the liquid crystal thickness of a reflective field is set to about 2.5-3 micrometers] about 3 micrometers. For example, this sake, It also has the problem that will be easy to generate the faulty connection in a contact hole 17, and the area of a contact hole 17 will also become large, and the utilization effectiveness of reflectors 4 and 5 will worsen.
[0031] It is made hard to happen in poor contact of the reflector of the liquid crystal display of the mold both for transparency reflective, and a thin film transistor, and the place which this invention is made in view of the trouble of these former, and is made into the object raises the utilization effectiveness of an ambient light, and is to offer the liquid crystal display of the mold both for transparency reflective which has a good display property.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] In order to attain the object mentioned above, the liquid crystal display of this invention The pixel electrode which constitutes the reflector which reflects outdoor daylight on the substrate of the one side of the substrates of the couple which counters mutually and is arranged on both sides of a liquid crystal layer, and the transparency electrode which penetrates the light from the tooth-back light source in 1 pixel, In the liquid crystal display with which it comes to form the switching element section which impresses the electrical potential difference for a display to this pixel electrode, while an interlayer insulation film is formed on the substrate of said one side It comes electrically to connect the drain electrode which constitutes said switching element section, and said transparency electrode under this interlayer insulation film. Said reflector While being formed on said interlayer insulation film, it is characterized by connecting this reflector and a transparency electrode electrically in the border area of this reflector and a transparency electrode.
[0033] Moreover, it is desirable that said interlayer insulation film at this time covers all on the switching element section containing said drain electrode, and is formed, and a contact hole does not exist on said reflector.
[0034] Furthermore, as for said reflector and said transparency electrode at this time, it is desirable to connect electrically only in the border area of this reflector and a transparency electrode.
[0035] Hereafter, an operation of this invention is explained.
[0036] Without making the invalid viewing area in a display pixel field increase conventionally, since according to the liquid crystal display of this invention it is constituted so that a reflector and a transparency electrode may connect electrically in the border area of a reflector and a transparency electrode, two electrodes can be connected certainly and it is possible to reduce poor contact.
[0037] Moreover, since a reflector and a transparency electrode can be connected electrically, without forming the contact hole which existed in the reflector field in a display pixel field until now, it is also possible to raise the numerical aperture of a reflector field and to raise the utilization effectiveness of an ambient light.
[0038] Furthermore, since it becomes unnecessary to form the interlayer film which existed between the reflector and the transparency electrode until now, it is also possible for impressing an electrical potential difference to liquid crystal through an interlayer film to be lost, and to raise the display engine performance of a transparency electrode field.
[0039]
[Embodiment of the Invention] Hereafter, the gestalt of the operation in this invention is explained based on a drawing.
[0040] (Gestalt 1 of operation) Drawing 1 is the top view having shown the configuration for a picture element part of the liquid crystal display in the gestalt 1 of this operation, and drawing 2 is the A-A line sectional view.
[0041] The liquid crystal display of the gestalt 1 of this operation is formed on the insulating substrate 1 from a thin film transistor 18, the transparency electrode 2 electrically connected to the drain electrode 13 of this thin film transistor 18, and this thin film transistor 18 and the transparency electrode 2 and the reflectors 4 and 5 arranged through an interlayer insulation film 3, as shown in drawing 1 and drawing 2 . And in that border area, it connects electrically and these transparency electrode 2 and reflectors 4 and 5 are constituted.
[0042] Thus, since the transparency electrode 2 and reflectors 4 and 5 which constitute a pixel

electrode from a liquid crystal display in the gestalt 1 of this operation are contacted directly and connected electrically, it is possible to use conventionally the invalid viewing area which was not able to be used for the transparency viewing area and the reflective viewing area as a connection of the transparency electrode 2 and reflectors 4 and 5.

[0043] Moreover, by considering as such a configuration, it is possible to prevent conventionally the faulty connection of the transparency electrode 2 and reflectors 4 and 5 which had been generated in the contact hole, and it is also possible to raise the rate of an excellent article of a liquid crystal display.

[0044] As a cure against electric corrosion in the photoresist exfoliation process of the cascade screen pattern of aluminum4/Mo5 which originates in contacting directly the transparency electrode 2 and reflectors 4 and 5 which constitute a pixel electrode, and connecting them electrically here, and is generated With the gestalt 1 of this operation, a backwashing-by-water process which prevents preparing two or more another tubs in front of a rinse tank, and the water and MEA in a rinse tank being mixed, and becoming alkalinity is performed so that it may mention later.

[0045] Here, drawing 3 (a) - (d) and drawing 4 (e) - (h) is the sectional view having shown the process of the transparency display and reflective display in a part for a picture element part of a liquid crystal display in the gestalt 1 of this operation.

[0046] The transparency display and reflective display which constitute a part for the picture element part of the liquid crystal display in the gestalt 1 of this operation are explained with reference to (a) - (h) of drawing 3 and drawing 4 . first, it is shown in drawing 3 (a) -- as -- the insulating substrate 1 top -- as the base coat film -- Ta2 -- insulator layers, such as O5 and Si02, are formed (not shown), after that, patterning of the metal thin film which becomes the insulating substrate 1 from aluminum, Mo, Ta, etc. is created and carried out by the sputtering method, and the gate electrode 8 is formed.

[0047] Next, the gate electrode 8 mentioned above is covered and the laminating of the gate dielectric film 10 is carried out on the insulating substrate 1. Generally, with P-CVD method, 3000A laminating of the SiNx film was carried out, and it considered as gate dielectric film 10. In addition, in order to raise insulation, anodizing the gate electrode 8, using this oxide film on anode as the 1st gate dielectric film 9, forming the insulator layers 10, such as SiN, with a CVD method, and considering as the 2nd insulator layer 10 is also considered.

[0048] Next, the channel layer 11 (amorphous silicon) and the electrode contact layer 12 (the amorphous silicon or microcrystal (Si) which doped impurities, such as Lynn) are continued on gate dielectric film 10, with a CVD method, 500A laminating is carried out to 1500A, respectively, patterning of both the Si film of the electrode contact layer 12 and the channel layer 11 is carried out by the dry etching method by HCl+SF6 mixed gas etc., and it is formed.

[0049] Then, as shown in drawing 3 (b), 1500A laminating of the transparence electric conduction film (ITO) 2 and 13 is carried out as an electrode material which constitutes a transparency display by the sputtering method, then the laminating of the metal thin films 14 and 15, such as aluminum, Mo, and Ta film, is carried out. And the drain electrodes 13 and 15 are formed in the source electrode 13 and 14 lists by carrying out patterning of these. The drain electrode 13 and the electrode material 2 which constitutes a transparency display are connected electrically by this, and it is constituted.

[0050] Next, as shown in drawing 3 (c), 3000A laminating of the insulator layers, such as SiN, is carried out with a CVD method, it removes, patterning of the insulator layer which exists in the transparency viewing-area and contact hole section 17 top and the border area of a transparency viewing area and a reflective viewing area is carried out, and an interlayer film 7 is formed. Here, when removing an interlayer film 7 with the gestalt 1 of this operation, only a transparency viewing area was not removed but the interlayer film 7 which exists throughout the border area of a transparency viewing area and a transparency viewing area, and a reflective viewing area was removed. In addition, it is not necessary to necessarily remove the interlayer film 7 which exists in the border area of a transparency viewing area and a reflective viewing area over the whole region, and does not matter by removing the part as a configuration which the transparency electrode 2 and reflectors 4 and 5 connect electrically.

[0051] Next, two or more smooth concavo-convex sections 18 (not shown) are formed on a photopolymer 3 by heat-treating, after applying the photopolymer 3 used as an interlayer insulation

film by about 4-micrometer thickness on this interlayer film 7 and exposing and developing this photopolymer 3, as shown in drawing 3 (d). And the photopolymer 3 which exists on contact hole section 17 field and a transparency display field is removed.
[0052] Next, as shown in drawing 4 (e), the aluminum/Mo film 4 and 5 is formed 1000/500A thickness by the sputtering method as an electrode material which constitutes a reflective display on the substrate 1 containing an interlayer film 7 and a photopolymer 3.
[0053] And as shown in drawing 4 (f), on the electrode material 4 which constitutes a reflective display, and 5, a photolithography process is used and a photoresist 16 is formed at a predetermined configuration. Since Mo5 exists between ITO2 which is the electrode material which constitutes a transparency display, and aluminum4 which is the electrode material which constitutes a reflective display at this time, although an electrolytic solution sinks in from the film defective part of aluminum4 at the time of the development of a photoresist 16, since this Mo5 functions as a barrier metal, it has prevented that an electric corrosion reaction occurs.
[0054] And as shown in drawing 4 (g), the etchant which consists of nitric-acid + acetic-acid + phosphoric-acid + water is used, aluminum4/Mo5 which are the electrode material which constitutes a reflective display are etched simultaneously, and reflectors 4 and 5 are formed.
[0055] Finally, as shown in drawing 4 (h), the amount of [of the liquid crystal display of the mold both for transparency reflective mentioned above by removing the photoresist 16 formed by photolithography using the exfoliation equipment of a batch type] picture element part completes.
[0056] Here, the exfoliation equipment of a batch type used in order to remove the photoresist 16 formed by said photolithography is explained using drawing 5 . Drawing 5 (a) - (e) is the schematic diagram having shown the exfoliation process of the photoresist 16 of the batch type in the liquid crystal display of the mold both for transparency reflective mentioned above.
[0057] the substrate 20 which passed through a process which was mentioned above as shown in drawing 5 (a) - (e) -- as an amine -- MEA (monoethanolamine) -- 60wt(s)% -- in order to soak in the exfoliation liquid to contain and to remove the exfoliation liquid of substrate 20 front face after that, it soaks in a rinse tank 22 and rinses. After exfoliating in the exfoliation tub 21 like before shown in drawing 14 at this time, it washes in cold water in order of the exfoliation tub 21 (DMSO tub) which uses dimethyl sulfoxide as a principal component, and a rinse tank 22. If exfoliation is repeated without performing liquid exchange of the exfoliation tub 21 and a rinse tank 22 The MEA concentration in the exfoliation tub 21 becomes high, MEA will be continuously carried in in a rinse tank 22, alkalinity will become strong, and electric corrosion will occur in the contact part of the transparency electrode 2 and reflectors 4 and 5 in the border area of a transparency viewing area and a reflective viewing area.
[0058] So, with the gestalt 1 of this operation, as shown in drawing 5 (a) - (e), after dipping the substrate 20 in the exfoliation tub 21 and exfoliating, 2 ********s of another exfoliation tubs 21 were passed, and it rinsed by dipping in a rinse tank 22. By such approach, MEA is conventionally carried in in a rinse tank 22, alkalinity becomes strong, and it becomes possible to hardly carry in MEA no longer in a rinse tank 22, and to prevent generating of electric corrosion because what electric corrosion had generated in the contact part of the transparency electrode 2 and reflectors 4 and 5 in the border area of a transparency viewing area and a reflective viewing area makes the exfoliation tub 21 (DMSO tub) two tubs.
[0059] Thus, the orientation film is applied and calcinated to each of the TFT substrate which has a part for the manufactured picture element part, and the transparent opposite substrate (not shown) with which the transparency electrode was formed. And rubbing processing is performed to this orientation film, after sprinkling a spacer, liquid crystal is poured in for both these substrates by lamination and the vacuum pouring-in method by seal resin, and a liquid crystal display component is created. The liquid crystal display of the mold both for transparency reflective mentioned above by pouring in a liquid crystal ingredient, installing a polarizing plate and one phase contrast plate at a time in the both sides of a liquid crystal display component finally, respectively, and installing a back light in a tooth back is completed.
[0060] (Gestalt 2 of operation) Drawing 6 is the top view having shown the configuration for a picture element part of the liquid crystal display in the gestalt 2 of this operation, and drawing 7 is the A-A line sectional view.

[0061] The liquid crystal display of the gestalt 2 of this operation is formed on the insulating substrate 1 from a thin film transistor 18, the transparency electrode 2 electrically connected to the drain electrode 13 of this thin film transistor 18, and this thin film transistor 18 and the transparency electrode 2 and the reflectors 4 and 5 arranged through an interlayer insulation film 3, as shown in drawing 6 and drawing 7 . And in that border area, it connects electrically and these transparency electrode 2 and reflectors 4 and 5 are constituted.
[0062] Thus, since the transparency electrode 2 and reflectors 4 and 5 which constitute a pixel electrode from a liquid crystal display in the gestalt 2 of this operation are contacted directly and connected electrically, it is possible to use conventionally the invalid viewing area which was not able to be used for the transparency viewing area and the reflective viewing area as a connection of the transparency electrode 2 and reflectors 4 and 5.
[0063] Moreover, by considering as such a configuration, it is possible to prevent conventionally the faulty connection of the transparency electrode 2 and reflectors 4 and 5 which had been generated in the contact hole, and it is also possible to raise the rate of an excellent article of a liquid crystal display.
[0064] In addition, the liquid crystal displays in the gestalt 2 of this operation differ in the gestalt 1 of operation which the point which does not form the contact hole in the reflectors 4 and 5 formed on the interlayer insulation film 3 mentioned above, as shown in drawing 6 and drawing 7 .
[0065] Here, drawing 8 (a) - (d) and drawing 9 (e) - (h) is the sectional view having shown the process of the transparency display and reflective display in a part for a picture element part of a liquid crystal display in the gestalt 2 of this operation.
[0066] The transparency display and reflective display which constitute a part for the picture element part of the liquid crystal display in the gestalt 2 of this operation are explained with reference to (a) - (h) of drawing 8 and drawing 9 . first, it is shown in drawing 8 (a) -- as -- the insulating substrate 1 top -- as the base coat film -- Ta2 -- insulator layers, such as O5 and Si02, are formed (not shown), after that, patterning of the metal thin film which becomes the insulating substrate 1 from aluminum, Mo, Ta, etc. is created and carried out by the sputtering method, and the gate electrode 8 is formed.
[0067] Next, the gate electrode 8 mentioned above is covered and the laminating of the gate dielectric film 10 is carried out on the insulating substrate 1. Generally, with P-CVD method, 3000A laminating of the SiNx film was carried out, and it considered as gate dielectric film 10. In addition, in order to raise insulation, anodizing the gate electrode 8, using this oxide film on anode as the 1st gate dielectric film 9, forming the insulator layers 10, such as SiN, with a CVD method, and considering as the 2nd insulator layer 10 is also considered.
[0068] Next, the channel layer 11 (amorphous silicon) and the electrode contact layer 12 (the amorphous silicon or microcrystal (Si) which doped impurities, such as Lynn) are continued on gate dielectric film 10, with a CVD method, 500A laminating is carried out to 1500A, respectively, patterning of both the Si film of the electrode contact layer 12 and the channel layer 11 is carried out by the dry etching method by HCl+SF6 mixed gas etc., and it is formed.
[0069] Then, as shown in drawing 8 (b), 1500A laminating of the transparence electric conduction film (ITO) 2 and 13 is carried out as an electrode material which constitutes a transparency display by the sputtering method, then the laminating of the metal thin films 14 and 15, such as aluminum, Mo, and Ta film, is carried out. And the drain electrodes 13 and 15 are formed in the source electrode 13 and 14 lists by carrying out patterning of these. The drain electrode 13 and the electrode material 2 which constitutes a transparency display are connected electrically by this, and it is constituted.
[0070] Next, as shown in drawing 8 (c), 3000A laminating of the insulator layers, such as SiN, is carried out with a CVD method, it removes, patterning of the insulator layer which exists in the border area of a transparency viewing area and a transparency viewing area, and a reflective viewing area is carried out, and an interlayer film 7 is formed. Here, when removing an interlayer film 7 with the gestalt 2 of this operation, only a transparency viewing area was not removed but the interlayer film 7 which exists throughout the border area of a transparency viewing area and a transparency viewing area, and a reflective viewing area was removed. In addition, it is not necessary to necessarily remove the interlayer film 7 which exists in the border area of a transparency viewing area and a reflective viewing area over the whole region, and does not matter by removing the part as

a configuration which the transparency electrode 2 and reflectors 4 and 5 connect electrically.
[0071] Next, two or more smooth concavo-convex sections 18 (not shown) are formed on a photopolymer 3 by heat-treating, after applying the photopolymer 3 used as an interlayer insulation film by about 4-micrometer thickness on this interlayer film 7 and exposing and developing this photopolymer 3, as shown in drawing 8 (d). And the photopolymer 3 which exists on contact hole section 17 field and a transparency display field is removed.
[0072] Next, as shown in drawing 9 (e), the aluminum/Mo film 4 and 5 is formed 1000/500A thickness by the sputtering method as an electrode material which constitutes a reflective display on the substrate 1 containing an interlayer film 7 and a photopolymer 3.
[0073] And as shown in drawing 9 (f), on the electrode material 4 which constitutes a reflective display, and 5, a photolithography process is used and a photoresist 16 is formed at a predetermined configuration. Since Mo5 exists between ITO2 which is the electrode material which constitutes a transparency display, and aluminum4 which is the electrode material which constitutes a reflective display at this time, although an electrolytic solution sinks in from the film defective part of aluminum4 at the time of the development of a photoresist 16, since this Mo5 functions as a barrier metal, it has prevented that an electric corrosion reaction occurs.
[0074] And as shown in drawing 9 (g), the etchant which consists of nitric-acid + acetic-acid + phosphoric-acid + water is used, aluminum4/Mo5 which are the electrode material which constitutes a reflective display are etched simultaneously, and reflectors 4 and 5 are formed.
[0075] Finally, as shown in drawing 9 (h), the amount of [of the liquid crystal display of the mold both for transparency reflective in the gestalt 2 of this operation] picture element part completes by removing like the gestalt 1 of the operation which mentioned above the photoresist 16 formed by photolithography using the exfoliation equipment of a batch type.
[0076] Thus, the orientation film is applied and calcinated to each of the TFT substrate which has a part for the manufactured picture element part, and the transparent opposite substrate (not shown) with which the transparency electrode was formed. And rubbing processing is performed to this orientation film, after sprinkling a spacer, liquid crystal is poured in for both these substrates by lamination and the vacuum pouring-in method by seal resin, and a liquid crystal display component is created. The liquid crystal display of the mold both for transparency reflective mentioned above by pouring in a liquid crystal ingredient, installing a polarizing plate and one phase contrast plate at a time in the both sides of a liquid crystal display component finally, respectively, and installing a back light in a tooth back is completed.
[0077] Since the contact hole does not exist in the reflectors 4 and 5 formed on the interlayer insulation film 3 according to the liquid crystal display in the gestalt 2 of this operation, Irregularity can be formed also in the field on the interlayer insulation film 3 which was being conventionally made into the contact hole. The contact hole part which was not able to be used for a transparency viewing area and a reflective viewing area can be used as a reflective viewing area, and it is possible to make effective display pixel area expand.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing 1 is the amplification top view having shown the configuration for a picture element part of the liquid crystal display in the gestalt 1 of operation of this invention.
[Drawing 2] Drawing 2 is the expanded sectional view having shown the configuration for a picture element part of the liquid crystal display in the gestalt 1 of operation of this invention.
[Drawing 3] Drawing 3 (a) - (d) is the expanded sectional view having shown the process for a picture element part of the liquid crystal display in the gestalt 1 of operation of this invention.
[Drawing 4] Drawing 4 (e) - (h) is the expanded sectional view having shown the process for a picture element part of the liquid crystal display in the gestalt 1 of operation of this invention.
[Drawing 5] Drawing 5 (a) - (e) is the schematic diagram having shown the exfoliation process of the photoresist of the batch type in the gestalt of operation of this invention.
[Drawing 6] Drawing 6 is the amplification top view having shown the configuration for a picture element part of the liquid crystal display in the gestalt 2 of operation of this invention.
[Drawing 7] Drawing 7 is the expanded sectional view having shown the configuration for a picture element part of the liquid crystal display in the gestalt 2 of operation of this invention.
[Drawing 8] Drawing 8 (a) - (d) is the expanded sectional view having shown the process for a picture element part of the liquid crystal display in the gestalt 2 of operation of this invention.
[Drawing 9] Drawing 9 (e) - (h) is the expanded sectional view having shown the process for a picture element part of the liquid crystal display in the gestalt 2 of operation of this invention.
[Drawing 10] Drawing 10 is the amplification top view having shown the configuration for a picture element part of the liquid crystal display in the conventional technique.
[Drawing 11] Drawing 11 is the expanded sectional view having shown the configuration for a picture element part of the liquid crystal display in the conventional technique.
[Drawing 12] Drawing 12 (a) - (d) is the expanded sectional view having shown the process for a picture element part of the liquid crystal display in the conventional technique.
[Drawing 13] Drawing 12 (e) - (h) is the expanded sectional view having shown the process for a picture element part of the liquid crystal display in the conventional technique.
[Drawing 14] Drawing 14 (a) - (d) is the schematic diagram having shown the photoresist exfoliation process of single wafer processing in the conventional technique.
[Description of Notations]
1 Glass Substrate
2 Transparency Electrode Material (ITO)
3 Photopolymer (Interlayer Insulation Film)
4 Reflector Ingredient (Aluminum)
5 Reflector Ingredient (Mo)
6 Transparency Display
7 Insulator Layer
8 Gate Electrode
9 Oxide Film on Anode
10 Gate Dielectric Film
11 Channel Layer
12 Electrode Contact Layer

13 Source Drain Electrode (ITO)
14 Source Electrode (Ta)
15 Drain Electrode (Ta)
16 Photoresist
17 Contact Hole
18 Thin Film Transistor
20 Substrate
21 Exfoliation **** (DMSO Tub)
22 Rinse Tank

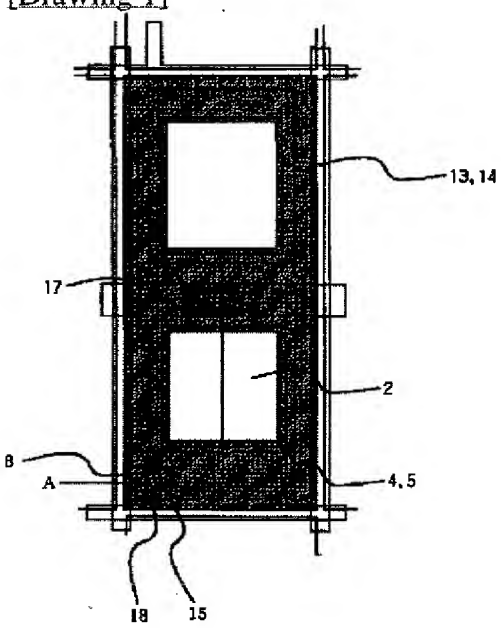
[Translation done.]

* NOTICES *

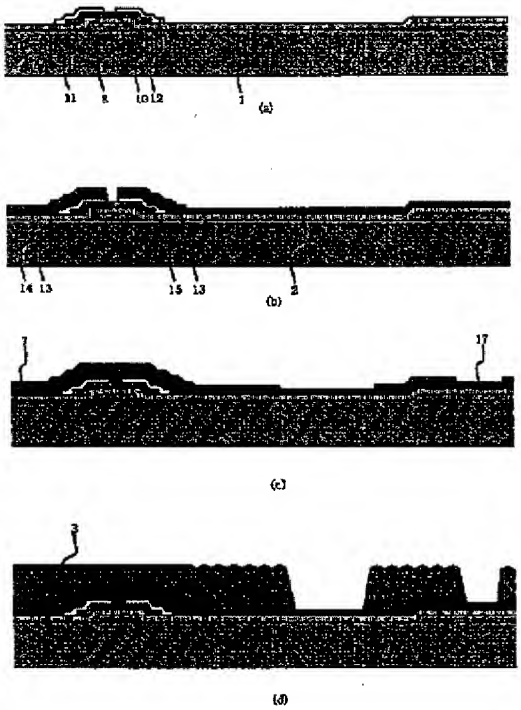
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

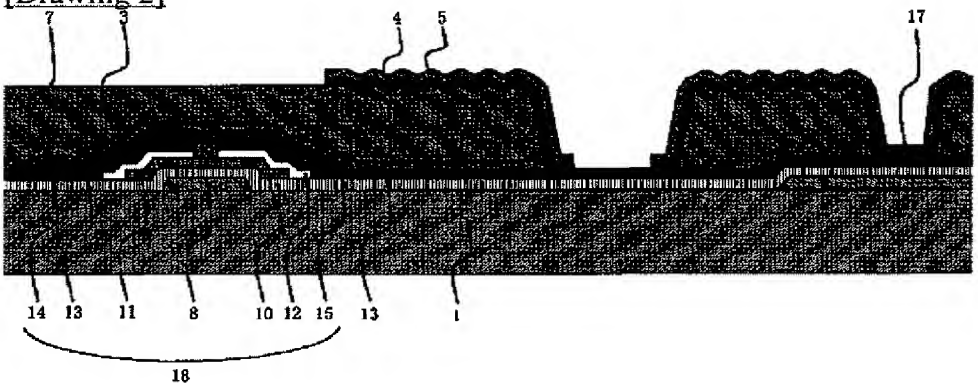
[Drawing 1]



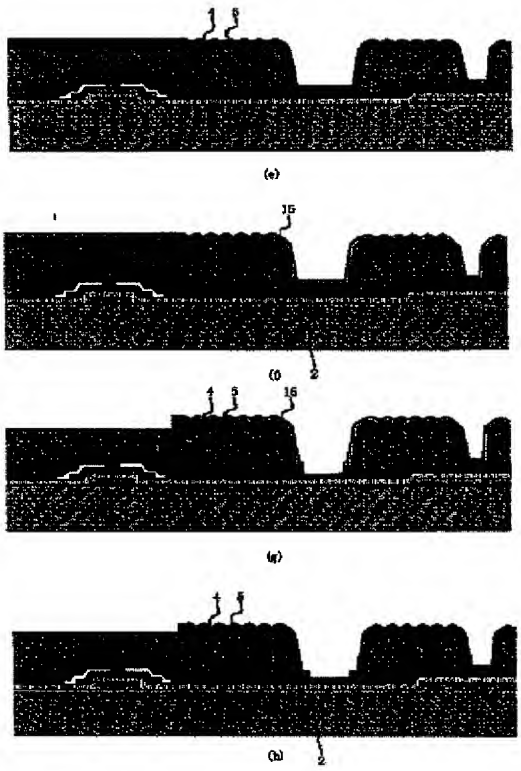
[Drawing 3]



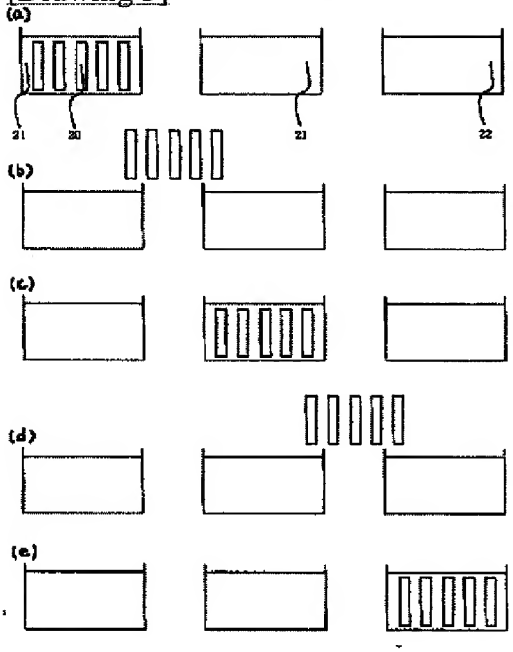
[Drawing 2]



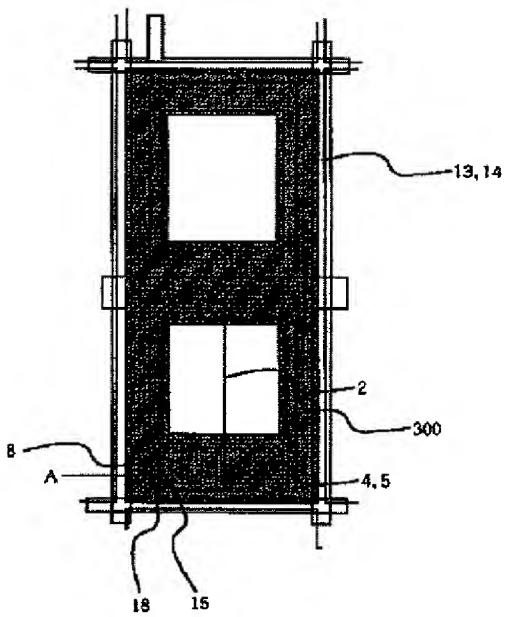
[Drawing 4]



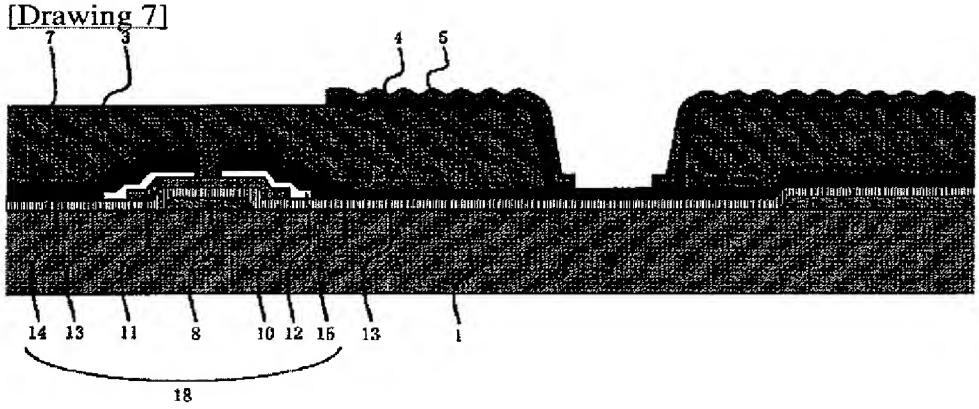
[Drawing 5]



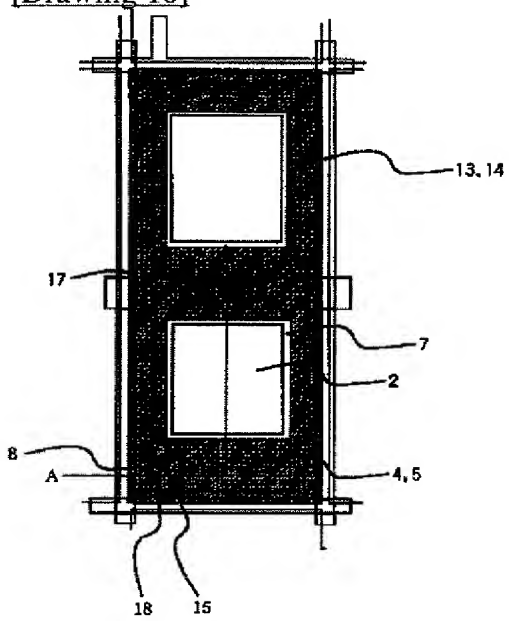
[Drawing 6]



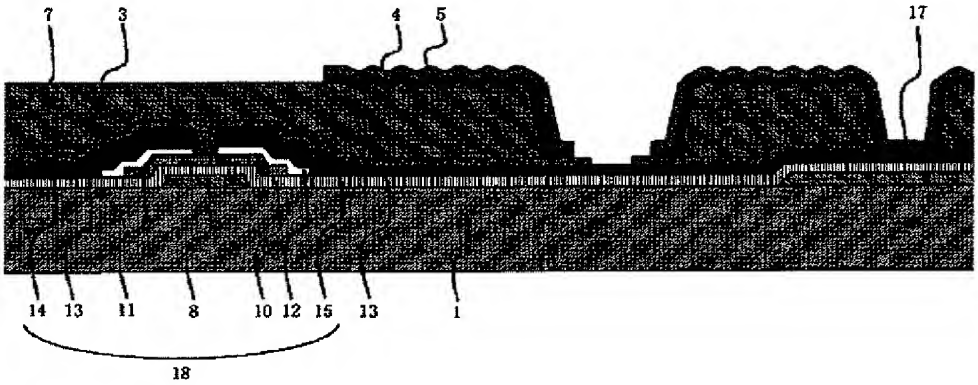
[Drawing 7]



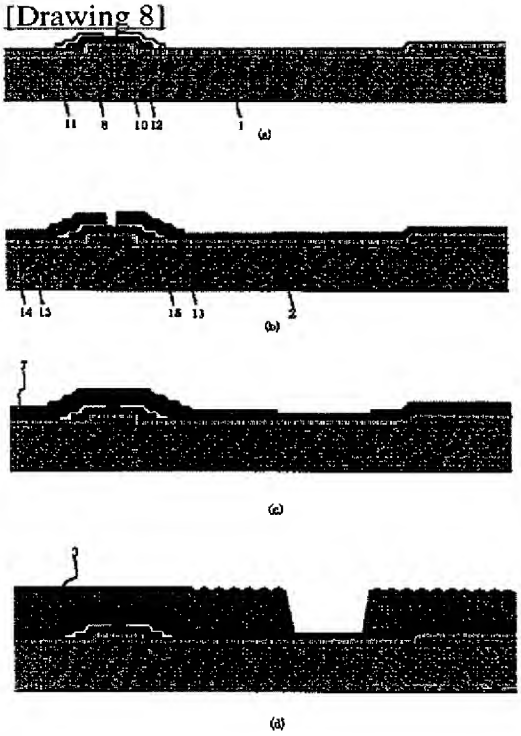
[Drawing 10]



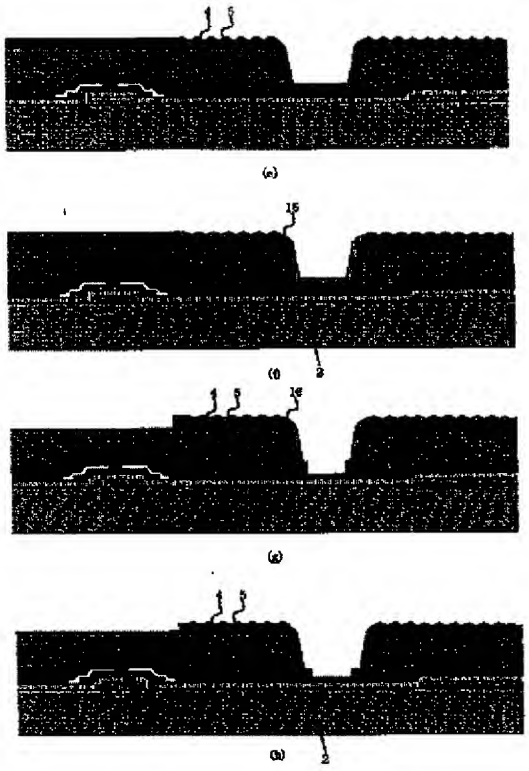
[Drawing 11]



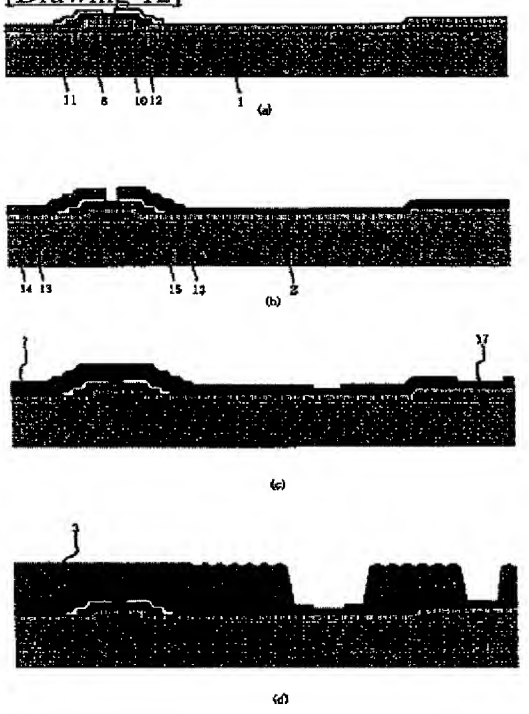
[Drawing 8]



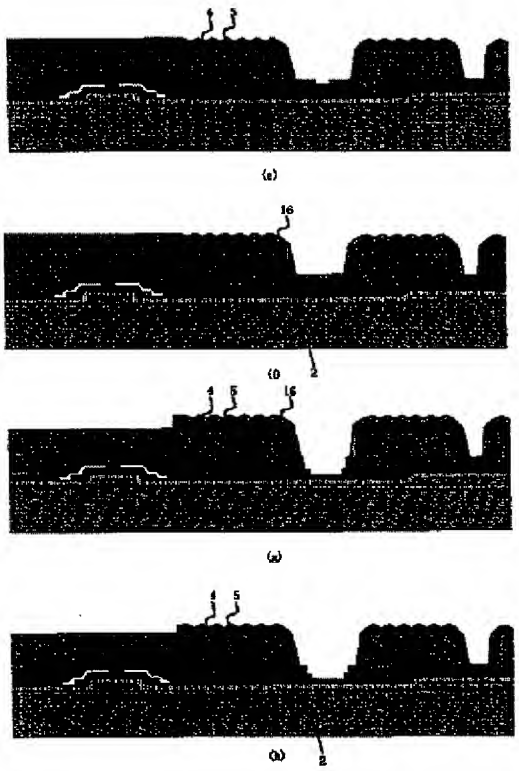
[Drawing 9]



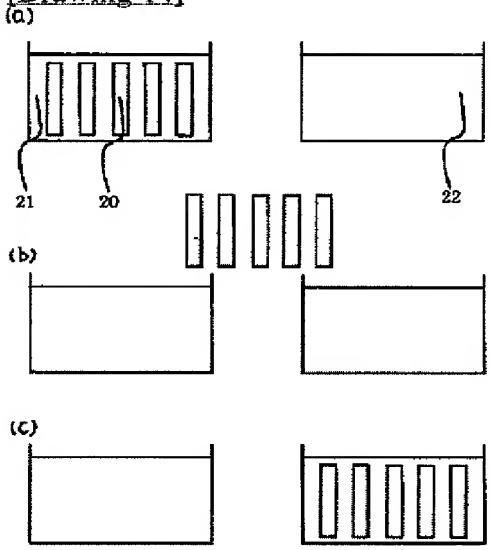
[Drawing 12]



[Drawing 13]



[Drawing 14]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)**公開特許公報（Ａ）**　(11)特許出願公開番号
特開2000－305110
（P2000－305110A）
(43)公開日　平成12年11月２日(2000.11.2)

(51)Int.Cl.'		識別記号	FI			テーマコード'（参考）
Ｇ０２Ｆ	1/1365		Ｇ０２Ｆ	1/136	５００	２Ｈ０９２
	1/1343			1/1343		５Ｃ０５８
Ｇ０９Ｆ	9/30	３４８	Ｇ０９Ｆ	9/30	３４８Ａ	５Ｃ０９４
		３４９			３４９Ｄ	５Ｆ１１０
Ｈ０１Ｌ	29/786		Ｈ０４Ｎ	5/66	１０２Ａ	

審査請求　未請求　請求項の数３　ＯＬ　（全 12 頁）　最終頁に続く

(21)出願番号　特願平11－110391

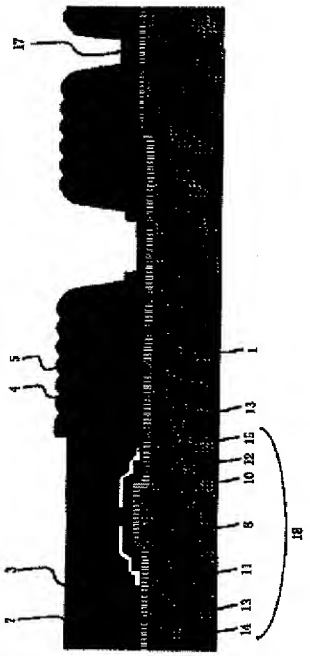
(22)出願日　平成11年４月19日(1999.4.19)

(71)出願人　000005049
シャープ株式会社
大阪府大阪市阿倍野区長池町22番22号
(72)発明者　久保　真澄
大阪府大阪市阿倍野区長池町22番22号　シャープ株式会社内
(72)発明者　山本　明弘
大阪府大阪市阿倍野区長池町22番22号　シャープ株式会社内
(74)代理人　100103296
弁理士　小池　隆彌

最終頁に続く

(54)【発明の名称】　液晶表示装置

(57)【要約】
【課題】　透過反射両用型の液晶表示装置の反射電極と薄膜トランジスタとのコンタクト不良を起こりにくくし、かつ周囲光の利用効率を向上させ、良好な表示特性を有する透過反射両用型の液晶表示装置を提供する。
【解決手段】　液晶層を挟んで互いに対向して配置される一対の基板のうちの一方側の基板上に、外光を反射する反射電極と背面光源からの光を透過する透過電極とを１画素内に構成する画素電極と、該画素電極に表示のための電圧を印加するスイッチング素子部とが形成されてなる液晶表示装置において、前記一方側の基板上には、前記スイッチング素子部を覆って層間絶縁膜が形成されるとともに、該スイッチング素子部を構成するドレイン電極と前記透過電極とが該層間絶縁膜の下で電気的に接続されてなり、前記反射電極は、前記層間絶縁膜の上に形成されるとともに、該反射電極と透過電極とが該反射電極と透過電極との境界領域で電気的に接続されるような構成とする。



【特許請求の範囲】
【請求項１】　液晶層を挟んで互いに対向して配置される一対の基板のうちの一方側の基板上に、外光を反射する反射電極と背面光源からの光を透過する透過電極とを１画素内に構成する画素電極と、該画素電極に表示のための電圧を印加するスイッチング素子部とが形成されてなる液晶表示装置において、
前記一方側の基板上には層間絶縁膜が形成されるとともに、前記スイッチング素子部を構成するドレイン電極と前記透過電極とが該層間絶縁膜の下で電気的に接続されてなり、
前記反射電極は、前記層間絶縁膜の上に形成されるとともに、該反射電極と透過電極とが該反射電極と透過電極との境界領域で電気的に接続されることを特徴とする液晶表示装置。
【請求項２】　前記層間絶縁膜は前記ドレイン電極を含むスイッチング素子部上の全てを覆って形成され、前記反射電極上にはコンタクトホールが存在しないことを特徴とする請求項１に記載の液晶表示装置。
【請求項３】　前記反射電極と前記透過電極とは、該反射電極と透過電極との境界領域でのみ電気的に接続されることを特徴とする請求項１に記載の液晶表示装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、ワードプロセッサやパーソナルコンピューターなどのＯＡ機器や、電子手帳などの携帯情報機器、あるいは液晶モニターを備えたカメラ一体型ＶＴＲなどに用いられる液晶表示装置に関する。
【０００２】
【従来の技術】近年、液晶表示装置は、薄型で低消費電力であるという特徴を生かして、ワードプロセッサやパーソナルコンピュータ、テレビ、ビデオカメラ、スチルカメラ、車載モニター、携帯ＯＡ機器、携帯ゲーム機などに広く用いられている。
【０００３】このような液晶表示装置には、画素電極にＩＴＯ（Ｉｎｄｉｕｍ　Ｔｉｎ　Ｏｘｉｄｅ）などの透過電極を用いた透過型の液晶表示装置と、画素電極に金属などの反射電極を用いた反射型の液晶表示装置とがある。
【０００４】本来、液晶表示装置はＣＲＴ（ブラウン管）やＥＬ（エレクトロルミネッセンス）などとは異なり、自ら発光する自発光型の表示装置ではないため、透過型の液晶表示装置の場合には、液晶表示装置の背後に蛍光管などの照明装置、所謂バックライトを配置して、そこから入射される光によって表示を行っている。また、反射型の液晶表示装置の場合には、外部からの入射光を反射電極によって反射させることによって表示を行っている。
【０００５】ここで、透過型の液晶表示装置の場合は、上述のようにバックライトを用いて表示を行うために、周囲の明るさにさほど影響されることなく、明るくて高コントラストを有する表示を行うことができるという利点を有しているものの、通常バックライトは液晶表示装置の全消費電力のうち５０％以上を消費することから、消費電力が大きくなってしまうという問題も有している。
【０００６】また、反射型の液晶表示装置の場合は、上述のようにバックライトを使用しないために、消費電力を極めて小さくすることができるという利点を有しているものの、周囲の明るさなどの使用環境あるいは使用条件によって表示の明るさやコントラストが左右されてしまうという問題も有している。
【０００７】このように、反射型の液晶表示装置においては、周囲の明るさなどの使用環境、特に外光が暗い場合には視認性が極端に低下するという欠点を有しており、また、一方の透過型の液晶表示装置においても、これとは逆に外光が非常に明るい場合、例えば晴天下などでの視認性が低下してしまうというような問題を有していた。
【０００８】こうした問題点を解決するための手段として、反射型と透過型との両方の機能を合わせ持った液晶表示装置が、例えば特願平９−２０１１７６号などにより提案されている。この特許出願により提案された液晶表示装置は、１つの表示画素に外光を反射する反射表示部（反射電極）とバックライトからの光を透過する透過表示部（透過電極）とを作り込むことにより、周囲が真っ暗の場合には、バックライトからの透過表示部を透過する光を利用して表示を行なう透過型液晶表示装置として、また、外光が暗い場合には、バックライトからの透過表示部を透過する光と光反射率の比較的高い膜により形成した反射表示部により反射する光との両方を利用して表示を行う両用型液晶表示装置として、さらに、外光が明るい場合には、光反射率の比較的高い膜により形成した反射表示部により反射する光のみを利用して表示を行う反射型液晶表示装置として用いることができるというものである。
【０００９】このような構成の液晶表示装置は、外光の明るさに関わらず、常に視認性が優れた液晶表示装置の提供を可能にしたものであり、このような透過反射両用型の液晶表示装置について、以下に簡単に説明する。
【００１０】図１０は、ここで従来技術として説明する透過反射両用型の液晶表示装置の画素部分の構成を示した平面図であり、図１１は、図１０におけるＡ−Ａ線断面図である。
【００１１】また、図１２（ａ）〜（ｄ）および図１３（ｅ）〜（ｈ）は、この透過反射両用型の液晶表示装置の画素部分における透過表示部と反射表示部との製造工程を示したプロセス断面図である。
【００１２】このような透過反射両用型の液晶表示装置

の画素部分を構成する透過表示部および反射表示部について、図10～13を参照して説明する。まず、図12（a）に示すように、絶縁性基板1上にベースコート膜としてTa_2O_5、$Si0_2$などの絶縁膜を形成し（図示せず）、その後、絶縁性基板1上に、Al、Mo、Taなどからなる金属薄膜をスパッタリング法にて作成し、パターニングしてゲート電極8を形成する。

【0013】次に、上述したゲート電極8を覆って絶縁性基板1上にゲート絶縁膜10を積層する。一般的には、P-CVD法により、SiNx膜を3000Å積層してゲート絶縁膜10とした。なお、絶縁性を高めるために、ゲート電極8を陽極酸化して、この陽極酸化膜を第1のゲート絶縁膜9とし、SiNなどの絶縁膜10をCVD法により形成して、第2の絶縁膜10とすることも考えられている。

【0014】次に、チャネル層11（アモルファスSi）と電極コンタクト層12（リン等の不純物をドーピングしたアモルファスSiまたは微結晶Si）とをゲート絶縁膜10上に連続してCVD法により、それぞれ1500Åと500Å積層し、電極コンタクト層12とチャネル層11との両Si膜をHCl+SF_6混合ガスによるドライエッチング法などによりパターニングして形成する。

【0015】その後、図12（b）に示すように、スパッタリング法により透過表示部を構成する電極材料として透明導電膜（ITO）2、13を1500Å積層し、続いて、Al、Mo、Ta膜等の金属薄膜14、15を積層する。そして、これらをパターニングすることにより、ソース電極13、14並びにドレイン電極13、15を形成する。

【0016】次に、図12（c）に示すように、SiNなどの絶縁膜をCVD法にて3000Å積層した後、コンタクトホール部17上に存在する絶縁膜を除去、パターニングして層間膜7を形成する。

【0017】次に、図12（d）に示すように、この層間膜7上に層間絶縁膜となる感光性樹脂3を約4μmの膜厚で塗布し、この感光性樹脂3を露光および現像した後に熱処理を行なうことにより、複数の滑らかな凹凸部18（図示せず）を感光性樹脂3上に形成する。そして、コンタクトホール部17領域上および透過表示部領域上に存在する感光性樹脂3を除去する。

【0018】次に、図13（e）に示すように、層間膜7および感光性樹脂3を含む基板1上に、反射表示部を構成する電極材料としてAl/Mo膜4、5をスパッタリング法により1000/500Åの膜厚により成膜する。

【0019】そして、図13（f）に示すように、反射表示部を構成する電極材料4、5上に、フォトリソグラフィー工程を用いて所定の形状にフォトレジスト16を形成する。このとき、透過表示部を構成する電極材料であるITO2と反射表示部を構成する電極材料であるA14との間にはMo5が存在しているので、フォトレジスト16の現像時にA14の膜欠陥部から電解質溶液がしみ込んでも、このMo5がバリアメタルとして機能するため電食反応が起こることを防止している。

【0020】そして、図13（g）に示すように、硝酸+酢酸+リン酸+水からなるエッチャントを使用して、反射表示部を構成する電極材料であるA14/Mo5を同時にエッチングして反射電極4、5を形成する。

【0021】最後に、図13（h）に示すように、フォトリソグラフィーにより形成されたフォトレジスト16をバッチ式の剥離装置を用いて除去することで、上述した透過反射両用型の液晶表示装置の画素部分は完成する。

【0022】ここで、前記フォトリソグラフィーにより形成されたフォトレジスト16を除去するために用いたバッチ式の剥離装置について図14を用いて説明する。図14（a）～（c）は、上述した透過反射両用型の液晶表示装置におけるバッチ式のフォトレジスト16の剥離工程を示した概略図である。

【0023】図14（a）～（c）に示すように、上述したような工程を経た基板20は、アミンとしてMEA（モノエタノールアミン）を60wt%含有する剥離液21に浸けられ、その後、基板20表面の剥離液21を取り除くために水22に浸けられて水洗される。この時、図14（b）に示すような基板20が剥離槽から水洗槽へ搬送される過程においては、基板20表面には剥離液21が付着した状態となっており、この基板20を水洗槽に浸けることにより、基板20表面でMEA21と水22とが混ざりアルカリ性が強くなる。

【0024】しかしながら、上述した透過反射両用型の液晶表示装置では、透過表示部と反射表示部との境界領域において、図11の断面図に示すように、透過表示部を構成する電極材料であるITO2と反射表示部を構成する電極材料であるA14/Mo5とが直接接触しないように、層間膜7と反射電極4、5とがパターニングされているので、透過電極材料であるITO2と反射電極材料であるA14との間に電食を起こすことなくフォトレジスト16を除去することができるというものである。

【0025】このようにして製造された画素部分を有するTFT基板と、透過電極が形成された透明な対向基板（図示せず）とのそれぞれに配向膜を塗布して焼成する。そして、この配向膜にラビング処理を施し、スペーサーを散布してからシール樹脂でこれらの両基板を貼り合せ、真空注入法により液晶を注入して、液晶表示素子を作成する。最後に、液晶材料を注入して、偏光板と位相差板とをそれぞれ液晶表示素子の両側に1枚ずつ設置し、背面にバックライトを設置することで、上述した透過反射両用型の液晶表示装置は完成する。

【００２６】
【発明が解決しようとする課題】上述したような構成の透過反射両用型の液晶表示装置は、透過表示部を構成する電極材料２と反射表示部を構成する電極材料４、５とが直接接触しないように層間膜７が形成されていることから、透過電極材料２と反射電極材料４、５との間に起こる電食を防止することに対しては有効な構成である。
【００２７】しかしながら、このような構成の場合には、透過表示部を構成する電極材料２と反射表示部を構成する電極材料４、５と層間膜７との重なり部分が、表示画素領域内にありながら、透過表示にも反射表示にも使用することのできない無効表示領域となってしまうことから、表示装置として開口率が低下してしまうという問題点を有していた。
【００２８】また、このときの反射領域および透過領域の境界領域における層間膜７は、反射電極４、５のパターニングずれ考慮して、反射電極４、５のエッジ部分よりもかなり大きめに形成しておく必要があり、そのため、透過領域の一部で層間膜７を介して液晶に電圧を印加しなくてはならない領域が存在してしまうことになり、透過領域における表示の透過率やコントラストが低下してしまうという問題も有していた。
【００２９】さらに、このような透過反射両用型の液晶表示装置において反射表示を行う際には、１つの画素を透過領域と反射領域とで分割しなければならないうえに、コンタクトホール１７がこの反射領域内に存在していることから、十分な反射表示を行うための反射電極４、５の面積の確保が困難となり、周囲光の利用効率が悪いという問題点も有していた。
【００３０】一般的に、上述したような透過反射両用型の液晶表示装置では、層間絶縁膜（感光性樹脂）３を介して透過電極２と反射電極４、５とを電気的に接続する必要があることから、層間絶縁膜３にコンタクトホール１７を形成する必要がある。特に、偏光モードを使用する場合には、層間絶縁膜３の膜厚を利用して反射領域と透過領域との光路長を調整することで、この両者間の電気光学特性のマッチングを図る必要がある。通常、透過領域の液晶層の層厚は、反射領域の液晶層の層厚の２倍程度に設定する必要があり、例えば、透過領域の液晶層厚が通常５～６μｍ程度であることから、反射領域の液晶層厚は２．５～３μｍ程度になるように層間絶縁膜３を３μｍ程度という厚い膜厚に形成する必要があり、このため、コンタクトホール１７における接続不良が発生し易く、また、コンタクトホール１７の面積も大きくなってしまい、反射電極４、５の利用効率が悪くなってしまうという問題も有している。
【００３１】本発明は、これら従来の問題点に鑑みてなされたものであって、その目的とするところは、透過反射両型の液晶表示装置の反射電極と薄膜トランジスタとのコンタクト不良を起こりにくくし、かつ周囲光の利用効率を向上させ、良好な表示特性を有する透過反射両用型の液晶表示装置を提供することにある。
【００３２】
【課題を解決するための手段】上述した目的を達成するために、本発明の液晶表示装置は、液晶層を挟んで互いに対向して配置される一対の基板のうちの一方側の基板上に、外光を反射する反射電極と背面光源からの光を透過する透過電極とを１画素内に構成する画素電極と、該画素電極に表示のための電圧を印加するスイッチング素子部とが形成されてなる液晶表示装置において、前記一方側の基板上には層間絶縁膜が形成されるとともに、前記スイッチング素子部を構成するドレイン電極と前記透過電極とが該層間絶縁膜の下で電気的に接続されてなり、前記反射電極は、前記層間絶縁膜の上に形成されるとともに、該反射電極と透過電極とが該反射電極と透過電極との境界領域で電気的に接続されることを特徴としている。
【００３３】また、このときの前記層間絶縁膜は前記ドレイン電極を含むスイッチング素子部上の全てを覆って形成され、前記反射電極上にはコンタクトホールが存在しないことが好ましい。
【００３４】さらに、このときの前記反射電極と前記透過電極とは、該反射電極と透過電極との境界領域でのみ電気的に接続されることが好ましい。
【００３５】以下、本発明の作用について説明する。
【００３６】本発明の液晶表示装置によれば、反射電極と透過電極とが、反射電極と透過電極との境界領域で電気的に接続するように構成されているため、表示画素領域内における無効表示領域を従来よりも増加させることなく、確実に両電極を接続することができ、コンタクト不良を低減させることが可能となっている。
【００３７】また、これまで表示画素領域内の反射電極領域に存在していたコンタクトホールを形成することなく反射電極と透過電極とを電気的に接続することができるため、反射電極領域の開口率を向上させ、周囲光の利用効率を向上させることも可能となっている。
【００３８】さらに、これまで反射電極と透過電極との間に存在していた層間膜を形成する必要がなくなるため、層間膜を介して液晶に電圧を印加することがなくなり、透過電極領域の表示性能を向上させることも可能となっている。
【００３９】
【発明の実施の形態】以下、本発明における実施の形態について図面に基づいて説明する。
【００４０】（実施の形態１）図１は、本実施の形態１における液晶表示装置の画素部分の構成を示した平面図であり、図２は、そのＡ－Ａ線断面図である。
【００４１】本実施の形態１の液晶表示装置は、図１および図２に示すように、絶縁性基板１上に、薄膜トランジスタ１８と、この薄膜トランジスタ１８のドレイン電

極１３に電気的に接続された透過電極２と、この薄膜トランジスタ１８および透過電極２と層間絶縁膜３を介して配置された反射電極４、５とから形成されている。そして、この透過電極２と反射電極４、５とは、その境界領域において、電気的に接続されて構成されている。

【００４２】このように、本実施の形態１における液晶表示装置では、画素電極を構成する透過電極２と反射電極４、５とを直接接触させて電気的に接続させているため、従来、透過表示領域にも反射表示領域にも使用することができなかった無効表示領域を透過電極２と反射電極４、５との接続部として利用することが可能となっている。

【００４３】また、このような構成とすることにより、従来、コンタクトホールにおいて発生していた透過電極２と反射電極４、５との接続不良を防止することが可能となっており、液晶表示装置の良品率を向上させることも可能となっている。

【００４４】ここで、画素電極を構成する透過電極２と反射電極４、５とを直接接触させて電気的に接続させていることに起因して発生するＡｌ４／Ｍｏ５の積層膜パターンのフォトレジスト剥離工程における電食対策としては、本実施の形態１では、後述するように、水洗槽の前に複数の別の槽を設けるなどして水洗槽での水とＭＥＡとが混ざってアルカリ性になることを防止するような水洗浄プロセスを行っている。

【００４５】ここで、図３（ａ）～（ｄ）および図４（ｅ）～（ｈ）は、本実施の形態１における液晶表示装置の画素部分における透過表示部と反射表示部とのプロセスを示した断面図である。

【００４６】本実施の形態１における液晶表示装置の画素部分を構成する透過表示部および反射表示部について、図３および図４の（ａ）～（ｈ）を参照して説明する。まず、図３（ａ）に示すように、絶縁性基板１上にベースコート膜としてTa_2O_5、SiO_2などの絶縁膜を形成し（図示せず）、その後、絶縁性基板１に、Ａｌ、Ｍｏ、Ｔａなどからなる金属薄膜をスパッタリング法にて作成し、パターニングしてゲート電極８を形成する。

【００４７】次に、上述したゲート電極８を覆って絶縁性基板１上にゲート絶縁膜１０を積層する。一般的には、Ｐ－ＣＶＤ法により、ＳｉＮｘ膜を３０００Å積層してゲート絶縁膜１０とした。なお、絶縁性を高めるために、ゲート電極８を陽極酸化して、この陽極酸化膜を第１のゲート絶縁膜９とし、ＳｉＮなどの絶縁膜１０をＣＶＤ法により形成して、第２の絶縁膜１０とすることも考えられている。

【００４８】次に、チャネル層１１（アモルファスＳｉ）と電極コンタクト層１２（リン等の不純物をドーピングしたアモルファスＳｉまたは微結晶Ｓｉ）とをゲート絶縁膜１０上に連続してＣＶＤ法により、それぞれ１５００Åと５００Å積層し、電極コンタクト層１２とチャネル層１１との両Ｓｉ膜を$HCl+SF_6$混合ガスによるドライエッチング法などによりパターニングして形成する。

【００４９】その後、図３（ｂ）に示すように、スパッタリング法により透過表示部を構成する電極材料として透明導電膜（ＩＴＯ）２、１３を１５００Å積層し、続いて、Ａｌ、Ｍｏ、Ｔａ膜等の金属薄膜１４、１５を積層する。そして、これらをパターニングすることにより、ソース電極１３、１４並びにドレイン電極１３、１５を形成する。これにより、ドレイン電極１３と透過表示部を構成する電極材料２とが電気的に接続されて構成される。

【００５０】次に、図３（ｃ）に示すように、ＳｉＮなどの絶縁膜をＣＶＤ法にて３０００Å積層し、透過表示領域、コンタクトホール部１７上および透過表示領域と反射表示領域との境界領域に存在する絶縁膜を除去、パターニングして層間膜７を形成する。ここで、本実施の形態１では、層間膜７を除去する際、透過表示領域だけを除去するのではなく、透過表示領域および透過表示領域と反射表示領域との境界領域の全域に存在する層間膜７を除去した。なお、必ずしも透過表示領域と反射表示領域との境界領域に存在する層間膜７を全域にわたって除去する必要はなく、その一部を除去することにより、透過電極２と反射電極４、５とが電気的に接続するような構成としても構わない。

【００５１】次に、図３（ｄ）に示すように、この層間膜７上に層間絶縁膜となる感光性樹脂３を約４μｍの膜厚で塗布し、この感光性樹脂３を露光および現像した後に熱処理を行なうことにより、複数の滑らかな凹凸部１８（図示せず）を感光性樹脂３上に形成する。そして、コンタクトホール部１７領域上および透過表示部領域上に存在する感光性樹脂３を除去する。

【００５２】次に、図４（ｅ）に示すように、層間膜７および感光性樹脂３を含む基板１上に、反射表示部を構成する電極材料としてＡｌ／Ｍｏ膜４、５をスパッタリング法により１０００／５００Åの膜厚により成膜する。

【００５３】そして、図４（ｆ）に示すように、反射表示部を構成する電極材料４、５上に、フォトリソグラフィー工程を用いて所定の形状にフォトレジスト１６を形成する。このとき、透過表示部を構成する電極材料であるＩＴＯ２と反射表示部を構成する電極材料であるＡｌ４との間にはＭｏ５が存在しているので、フォトレジスト１６の現像時にＡｌ４の膜欠陥部から電解質溶液がしみ込んでも、このＭｏ５がバリアメタルとして機能するため電食反応が起こることを防止している。

【００５４】そして、図４（ｇ）に示すように、硝酸＋酢酸＋リン酸＋水からなるエッチャントを使用して、反射表示部を構成する電極材料であるＡｌ４／Ｍｏ５を同

時にエッチングして反射電極４、５を形成する。

【００５５】最後に、図４（ｈ）に示すように、フォトリソグラフィーにより形成されたフォトレジスト１６をバッチ式の剥離装置を用いて除去することで、上述した透過反射両用型の液晶表示装置の画素部分は完成する。

【００５６】ここで、前記フォトリソグラフィーにより形成されたフォトレジスト１６を除去するために用いたバッチ式の剥離装置について図５を用いて説明する。図５（ａ）～（ｅ）は、上述した透過反射両用型の液晶表示装置におけるバッチ式のフォトレジスト１６の剥離工程を示した概略図である。

【００５７】図５（ａ）～（ｅ）に示すように、上述したような工程を経た基板２０は、アミンとしてＭＥＡ（モノエタノールアミン）を６０ｗｔ％含有する剥離液に浸けられ、その後、基板２０表面の剥離液を取り除くために、水洗槽２２に浸けられて水洗される。この時、図１４に示す従来のように、剥離槽２１で剥離した後、ジメチルスルホキシドを主成分とする剥離槽２１（ＤＭＳＯ槽）、水洗槽２２の順で水洗いして、剥離槽２１、水洗槽２２の液交換を行わずに剥離を繰り返してしまうと、剥離槽２１内のＭＥＡ濃度が高くなってしまい、続いて水洗槽２２内にＭＥＡが持ち込まれて、アルカリ性が強くなり、透過表示領域と反射表示領域との境界領域における透過電極２と反射電極４、５との接触部分で電食が発生してしまう。

【００５８】そこで、本実施の形態１では、図５（ａ）～（ｅ）に示すように、基板２０を剥離槽２１に浸して剥離した後、別の剥離槽２１を２槽続けて通過させ、水洗槽２２に浸して水洗を行った。このような方法により、従来水洗槽２２内にＭＥＡが持ち込まれてアルカリ性が強くなり、透過表示領域と反射表示領域との境界領域における透過電極２と反射電極４、５との接触部分で電食が発生していたものが、剥離槽２１（ＤＭＳＯ槽）を２槽にすることで、水洗槽２２内にＭＥＡがほとんど持ち込まれなくなり、電食の発生を防止することが可能になる。

【００５９】このようにして製造された画素部分を有するＴＦＴ基板と、透過電極が形成された透明な対向基板（図示せず）とのそれぞれに配向膜を塗布して焼成する。そして、この配向膜にラビング処理を施し、スペーサーを散布してからシール樹脂でこれらの両基板を貼り合せ、真空注入法により液晶を注入して、液晶表示素子を作成する。最後に、液晶材料を注入して、偏光板と位相差板とをそれぞれ液晶表示素子の両側に１枚ずつ設置し、背面にバックライトを設置することで、上述した透過反射両用型の液晶表示装置は完成する。

【００６０】（実施の形態２）図６は、本実施の形態２における液晶表示装置の画素部分の構成を示した平面図であり、図７は、そのＡ－Ａ線断面図である。

【００６１】本実施の形態２の液晶表示装置は、図６および図７に示すように、絶縁性基板１上に、薄膜トランジスタ１８と、この薄膜トランジスタ１８のドレイン電極１３に電気的に接続された透過電極２と、この薄膜トランジスタ１８および透過電極２と層間絶縁膜３を介して配置された反射電極４、５とから形成されている。そして、この透過電極２と反射電極４、５とは、その境界領域において、電気的に接続されて構成されている。

【００６２】このように、本実施の形態２における液晶表示装置では、画素電極を構成する透過電極２と反射電極４、５とを直接接触させて電気的に接続させているため、従来、透過表示領域にも反射表示領域にも使用することができなかった無効表示領域を透過電極２と反射電極４、５との接続部として利用することが可能となっている。

【００６３】また、このような構成とすることにより、従来、コンタクトホールにおいて発生していた透過電極２と反射電極４、５との接続不良を防止することが可能となっており、液晶表示装置の良品率を向上させることも可能となっている。

【００６４】なお、本実施の形態２における液晶表示装置は、図６および図７に示すように、層間絶縁膜３上に形成された反射電極４、５にコンタクトホールを形成していない点が上述した実施の形態１とは異なっている。

【００６５】ここで、図８（ａ）～（ｄ）および図９（ｅ）～（ｈ）は、本実施の形態２における液晶表示装置の画素部分における透過表示部と反射表示部とのプロセスを示した断面図である。

【００６６】本実施の形態２における液晶表示装置の画素部分を構成する透過表示部および反射表示部について、図８および図９の（ａ）～（ｈ）を参照して説明する。まず、図８（ａ）に示すように、絶縁性基板１上にベースコート膜としてTa_2O_5、SiO_2などの絶縁膜を形成し（図示せず）、その後、絶縁性基板１に、Ａｌ、Ｍｏ、Ｔａなどからなる金属薄膜をスパッタリング法にて作成し、パターニングしてゲート電極８を形成する。

【００６７】次に、上述したゲート電極８を覆って絶縁性基板１上にゲート絶縁膜１０を積層する。一般的には、Ｐ－ＣＶＤ法により、ＳｉＮｘ膜を３０００Å積層してゲート絶縁膜１０とした。なお、絶縁性を高めるために、ゲート電極８を陽極酸化して、この陽極酸化膜を第１のゲート絶縁膜９とし、ＳｉＮなどの絶縁膜１０をＣＶＤ法により形成して、第２の絶縁膜１０とすることも考えられている。

【００６８】次に、チャネル層１１（アモルファスＳｉ）と電極コンタクト層１２（リン等の不純物をドーピングしたアモルファスＳｉまたは微結晶Ｓｉ）とをゲート絶縁膜１０上に連続してＣＶＤ法により、それぞれ１５００Åと５００Å積層し、電極コンタクト層１２とチャネル層１１との両Ｓｉ膜を$HCl+SF_6$混合ガスに

よるドライエッチング法などによりパターニングして形成する。

【0069】その後、図8（b）に示すように、スパッタリング法により透過表示部を構成する電極材料として透明導電膜（ITO）2、13を1500Å積層し、続いて、Al、Mo、Ta膜等の金属薄膜14、15を積層する。そして、これらをパターニングすることにより、ソース電極13、14並びにドレイン電極13、15を形成する。これにより、ドレイン電極13と透過表示部を構成する電極材料2とが電気的に接続されて構成される。

【0070】次に、図8（c）に示すように、SiNなどの絶縁膜をCVD法にて3000Å積層し、透過表示領域および透過表示領域と反射表示領域との境界領域に存在する絶縁膜を除去、パターニングして層間膜7を形成する。ここで、本実施の形態2では、層間膜7を除去する際、透過表示領域だけを除去するのではなく、透過表示領域および透過表示領域と反射表示領域との境界領域の全域に存在する層間膜7を除去した。なお、必ずしも透過表示領域と反射表示領域との境界領域に存在する層間膜7を全域にわたって除去する必要はなく、その一部を除去することにより、透過電極2と反射電極4、5とが電気的に接続するような構成としても構わない。

【0071】次に、図8（d）に示すように、この層間膜7上に層間絶縁膜となる感光性樹脂3を約4μmの膜厚で塗布し、この感光性樹脂3を露光および現像した後に熱処理を行なうことにより、複数の滑らかな凹凸部18（図示せず）を感光性樹脂3上に形成する。そして、コンタクトホール部17領域上および透過表示部領域上に存在する感光性樹脂3を除去する。

【0072】次に、図9（e）に示すように、層間膜7および感光性樹脂3を含む基板1上に、反射表示部を構成する電極材料としてAl／Mo膜4、5をスパッタリング法により1000／500Åの膜厚により成膜する。

【0073】そして、図9（f）に示すように、反射表示部を構成する電極材料4、5上に、フォトリソグラフィー工程を用いて所定の形状にフォトレジスト16を形成する。このとき、透過表示部を構成する電極材料であるITO2と反射表示部を構成する電極材料であるAl4との間にはMo5が存在しているので、フォトレジスト16の現像時にAl4の膜欠陥部から電解質溶液がしみ込んでも、このMo5がバリアメタルとして機能するため電食反応が起こることを防止している。

【0074】そして、図9（g）に示すように、硝酸＋酢酸＋リン酸＋水からなるエッチャントを使用して、反射表示部を構成する電極材料であるAl4／Mo5を同時にエッチングして反射電極4、5を形成する。

【0075】最後に、図9（h）に示すように、フォトリソグラフィーにより形成されたフォトレジスト16をバッチ式の剥離装置を用いて上述した実施の形態1と同様に除去することで、本実施の形態2における透過反射両用型の液晶表示装置の画素部分は完成する。

【0076】このようにして製造された画素部分を有するTFT基板と、透過電極が形成された透明な対向基板（図示せず）とのそれぞれに配向膜を塗布して焼成する。そして、この配向膜にラビング処理を施し、スペーサーを散布してからシール樹脂でこれらの両基板を貼り合せ、真空注入法により液晶を注入して、液晶表示素子を作成する。最後に、液晶材料を注入して、偏光板と位相差板とをそれぞれ液晶表示素子の両側に1枚ずつ設置し、背面にバックライトを設置することで、上述した透過反射両用型の液晶表示装置は完成する。

【0077】本実施の形態2における液晶表示装置によれば、層間絶縁膜3上に形成された反射電極4、5にはコンタクトホールが存在していないため、従来コンタクトホールとしていた層間絶縁膜3上の領域にも凹凸を形成することができ、透過表示領域にも反射表示領域にも利用することのできなかったコンタクトホール部分を反射表示領域として利用することができ、実効表示画素面積を拡大させることが可能となっている。

【0078】

【発明の効果】以上の説明のように、本発明の液晶表示装置によれば、反射電極と透過電極とが、反射電極と透過電極との境界領域で電気的に接続するように構成されているため、表示画素領域内における無効表示領域を従来よりも増加させることなく、確実に両電極を接続することができ、コンタクト不良を低減させることが可能となっている。

【0079】また、これまで表示画素領域内の反射電極領域に存在していたコンタクトホールを形成することなく反射電極と透過電極とを電気的に接続することができるため、反射電極領域の開口率を向上させ、周囲光の利用効率を向上させることも可能となっている。

【0080】さらに、これまで反射電極と透過電極との間に存在していた層間膜を形成する必要がなくなるため、層間膜を介して液晶に電圧を印加することがなくなり、透過電極領域の表示性能を向上させることも可能となっている。

【図面の簡単な説明】

【図1】図1は、本発明の実施の形態1における液晶表示装置の画素部分の構成を示した拡大平面図である。

【図2】図2は、本発明の実施の形態1における液晶表示装置の画素部分の構成を示した拡大断面図である。

【図3】図3（a）～（d）は、本発明の実施の形態1における液晶表示装置の画素部分のプロセスを示した拡大断面図である。

【図4】図4（e）～（h）は、本発明の実施の形態1における液晶表示装置の画素部分のプロセスを示した拡大断面図である。

【図5】図5（a）～（e）は、本発明の実施の形態におけるバッチ式のフォトレジストの剥離工程を示した概略図である。

【図6】図6は、本発明の実施の形態2における液晶表示装置の画素部分の構成を示した拡大平面図である。

【図7】図7は、本発明の実施の形態2における液晶表示装置の画素部分の構成を示した拡大断面図である。

【図8】図8（a）～（d）は、本発明の実施の形態2における液晶表示装置の画素部分のプロセスを示した拡大断面図である。

【図9】図9（e）～（h）は、本発明の実施の形態2における液晶表示装置の画素部分のプロセスを示した拡大断面図である。

【図10】図10は、従来技術における液晶表示装置の画素部分の構成を示した拡大平面図である。

【図11】図11は、従来技術における液晶表示装置の画素部分の構成を示した拡大断面図である。

【図12】図12（a）～（d）は、従来技術における液晶表示装置の画素部分のプロセスを示した拡大断面図である。

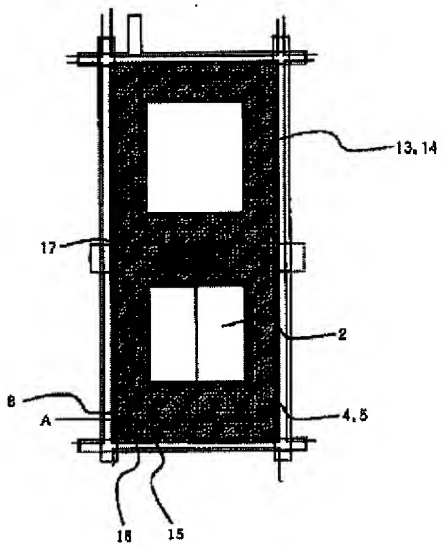
【図13】図12（e）～（h）は、従来技術における液晶表示装置の画素部分のプロセスを示した拡大断面図である。

【図14】図14（a）～（d）は、従来技術における枚葉式のフォトレジスト剥離工程を示した概略図である。

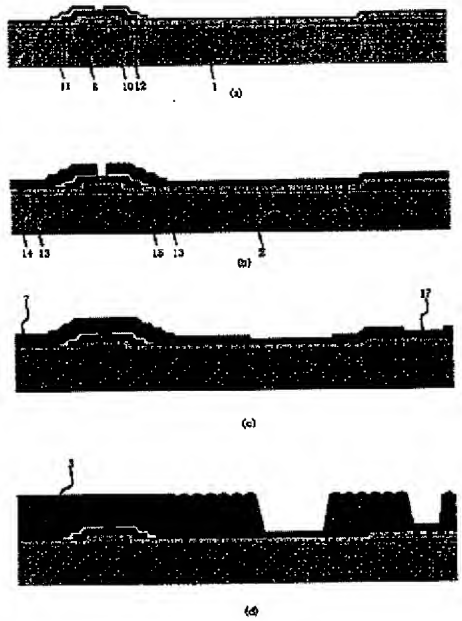
【符号の説明】

1	ガラス基板
2	透過電極材料（ＩＴＯ）
3	感光性樹脂（層間絶縁膜）
4	反射電極材料（Ａｌ）
5	反射電極材料（Ｍｏ）
6	透過表示部
7	絶縁膜
8	ゲート電極
9	陽極酸化膜
１０	ゲート絶縁膜
１１	チャネル層
１２	電極コンタクト層
１３	ソース・ドレイン電極（ＩＴＯ）
１４	ソース電極（Ｔａ）
１５	ドレイン電極（Ｔａ）
１６	フォトレジスト
１７	コンタクトホール
１８	薄膜トランジスタ
２０	基板
２１	剥離槽槽（ＤＭＳＯ槽）
２２	水洗槽

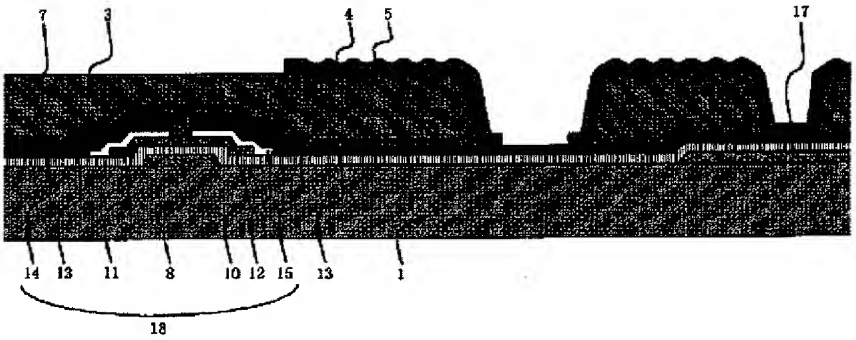
【図1】



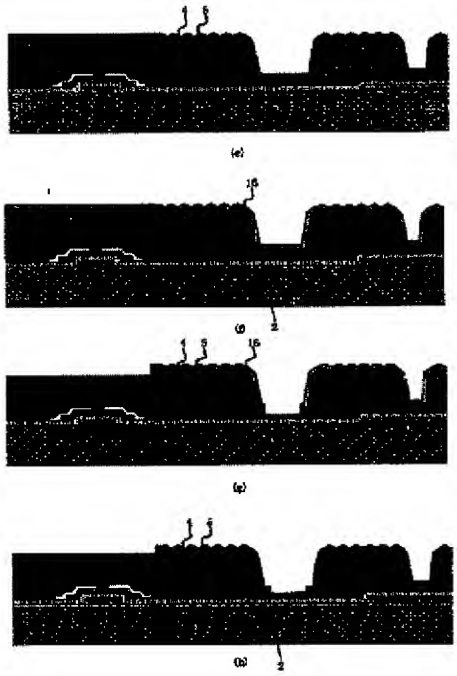
【図3】



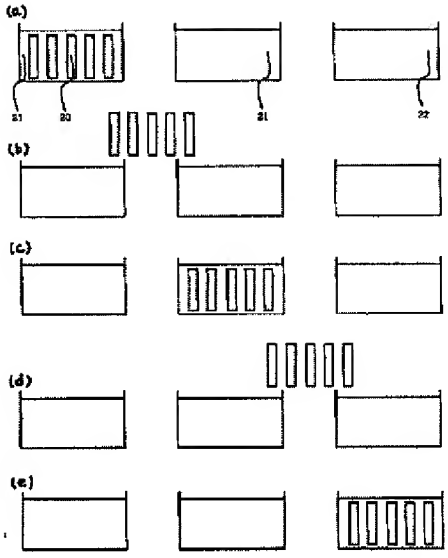
【図2】



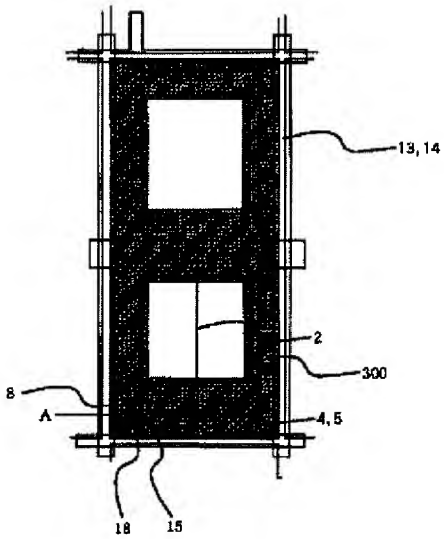
【図4】



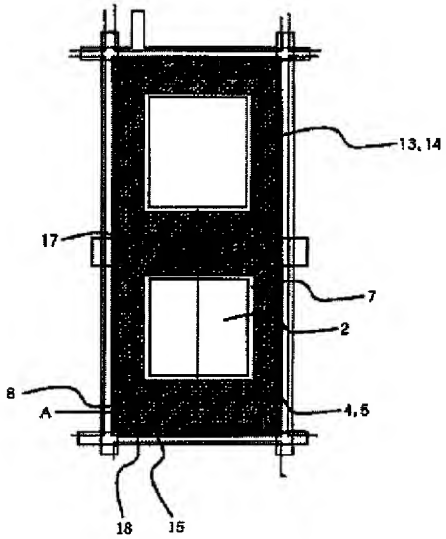
【図5】



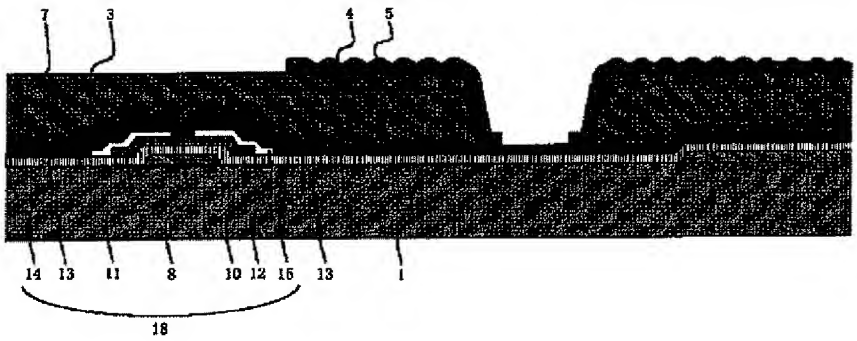
【図6】


13,14
2
300
8
A
4,5
18
15

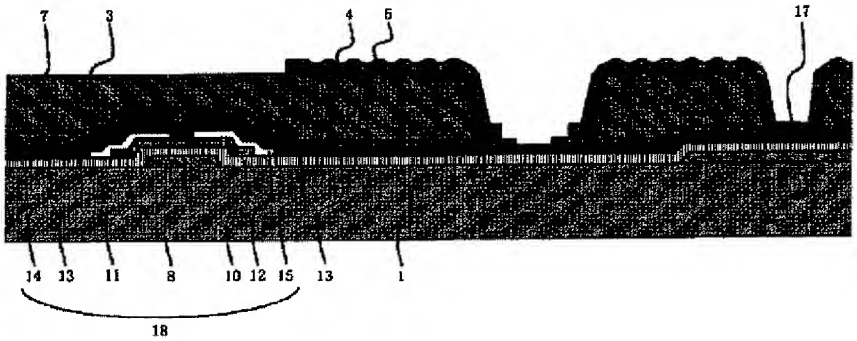
【図10】


13,14
17
7
2
8
A
4,5
18
15

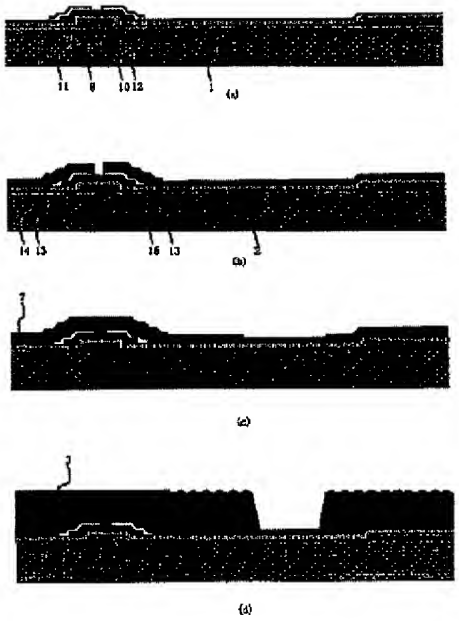
【図7】


7
3
4
5
14
13
11
8
10
12
15
13
1
18

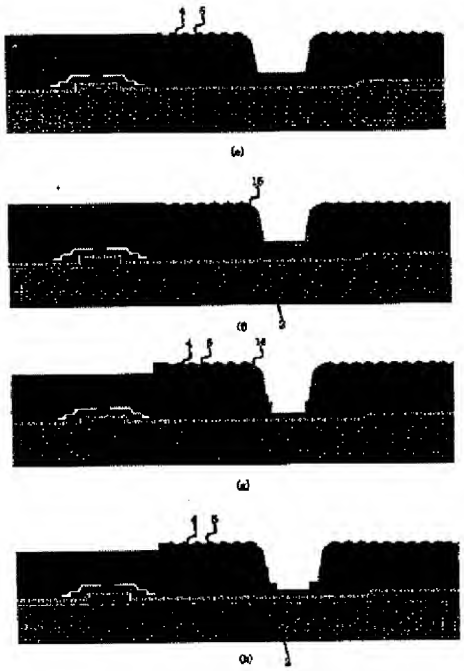
【図11】


7
3
4
5
17
14
13
11
8
10
12
15
13
1
18

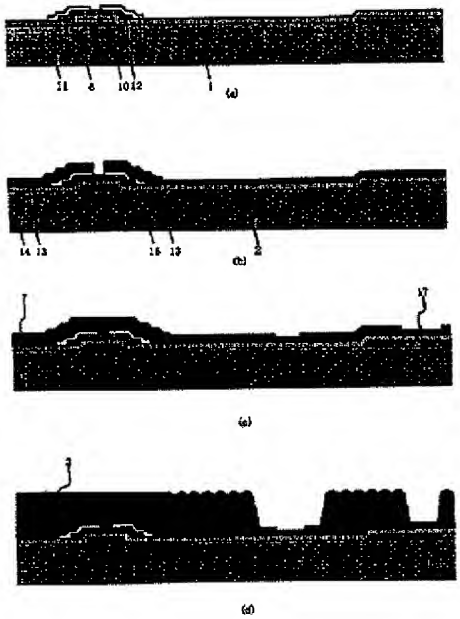
【図8】



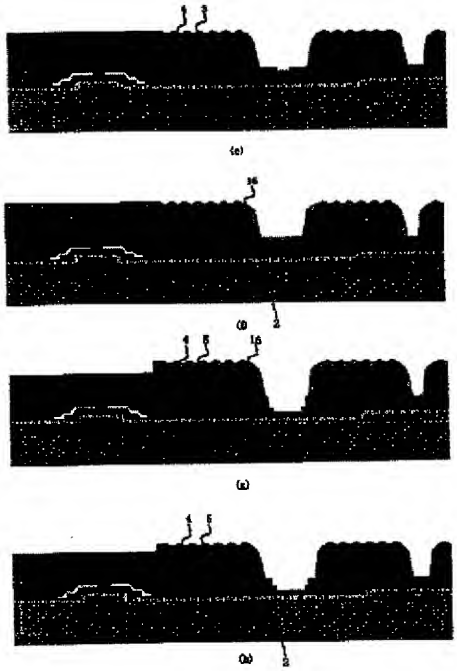
【図9】



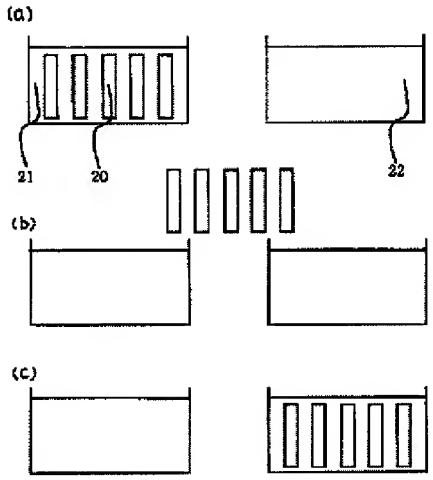
【図12】



【図13】



【図14】



フロントページの続き

(51)Int.Cl.[7]	識別記号	FI	テーマコード(参考)
H01L 21/336		H01L 29/78	612D
H04N 5/66	102		

Fターム(参考) 2H092 HA05 JA26 JA29 JA35 JA36
JA38 JA40 JA42 JA44 JA46
JB13 JB23 JB32 JB33 JB51
JB57 JB63 JB69 KA05 KA07
KA12 KA16 KA18 KB14 KB23
KB25 MA05 MA08 MA14 MA15
MA16 MA18 MA19 MA20 MA24
MA27 MA35 MA37 MA41 NA01
NA15 NA25 PA06 PA12
5C058 AA09 AB03 AB04 BA05 BA08
BA32 BA35
5C094 AA10 AA22 AA32 BA03 BA43
CA19 DA15 DB10 EA05 EA06
HA08
5F110 BB01 CC07 DD12 DD13 EE03
EE04 EE44 FF03 FF09 FF24
FF30 GG02 GG15 GG24 GG44
HK03 HK04 HK07 HK09 HK15
HK16 HK22 HK25 HK33 HK34
NN02 NN03 NN04 NN24 NN27
NN35 NN36 NN72 QQ01 QQ09